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# ALFRED KRUPP



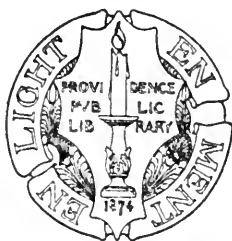
HIS LIFE AND WORK

BY

K. W. AND O. E. MICHAELIS

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*New York,*

*September, 1888.*



ALFRED KRUPP:  
A SKETCH OF HIS LIFE AND WORK,

AFTER THE GERMAN OF VICTOR NIEMEYER,

—BY—

K. W. AND O. E. MICHAELIS,

TO WHICH IS ADDED

A VISIT TO THE KRUPP WORKS AT ESSEN,

FROM THE FRENCH OF CAPTAIN E. MONTHAYE,

TRANSLATED BY CAPTAIN O. E. MICHAELIS, U. S. ARMY

C. S. 1

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## PREFACE.

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Comment upon this brief sketch of the life of a great man, would seem to us impertinence, and if it rouse in others the same sentiments with which it has inspired us, an introduction is needless. Alfred Krupp's life was Longfellow's noblest poem, *lived*—not written—and of him can it surely be said that he has, in dying, left behind him "footprints on the sands of time," that will comfort many a "shipwrecked brother," yet unborn.

KATE WOODBRIDGE MICHAELIS,  
OTHO E. MICHAELIS.

Kennebec Arsenal, September, 1888.







ALFRED KRUPP.



## ALFRED KRUPP.

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Alfred Krupp was born in Essen on the Ruhr, at No. 3 Flaxmarket (the corner of Limbecker street) on the twelfth of April, 1812.

At that time Essen was a little rural city with scarcely four thousand inhabitants. The existence of her store of under-ground wealth was barely known. Agriculture and farm pursuits were about the only source of her moderate prosperity. The hope of small-arms manufacture was a thing of the past. Where to-day countless stacks discharge their smoky clouds upward, where now varied industries pulsate with indefatigable eagerness, at that time only peaceful grazing grounds marked the quiet character of the country town.

Alfred Krupp came of a family settled at Essen for generations, having originally emigrated there from Bremen. Even as far back as 1664, an ancestor of his, Matthias Krupp, who appears to have been quite a personage, is mentioned as Town-Clerk, and in the year 1703, Arnold Krupp is flatteringly spoken of as Mayor of Essen.

As the first entry of the family upon home industrial pursuits, the purchase by the widow of the merchant Hermann Krupp (deceased 1790), of the well-known "Good Hope" Iron Works at Sterkrade is noteworthy.

Mrs. Krupp, by birth Amalie Ascherfeld, had held a mortgage upon the property since 1797, and when, after having been inactive for years, the Works came to sale

on April 12th 1800, she bid it in for 12,000 Reichsthaler. <sup>(1)</sup>

She succeeded in putting the impoverished plant into activity, but although under the protection of the Government Mining Department at Berlin, the "Good Hope" Works could not compete with its more favored rivals, especially with the admirably managed "Anthony" furnace of Recklinghausen, and so, on Sept. 14th, 1808, Mrs. Krupp abandoned the work and sold out to Henry Huyssen of Essen.

Still Mrs. Krupp's temporary management of the Sterkrade Works had a decided influence upon the mental development of her grandson, Friedrich Krupp, and indirectly, upon the life-work of her great-grandson, Alfred Krupp.

Friedrich Krupp, son of the merchant, Friedrich William Peter Krupp and his wife Petronella Forsthoff, <sup>(2)</sup> losing his father, for the times, a man of considerable means, while yet in early childhood, was brought up by his mother and energetic, gifted grandmother. After the latter came into possession of the Sterkrade plant, she soon put her grandson into harness, and gave him the opportunity of beginning his life's vocation as a metal worker.

Here Friedrich Krupp first imbibed the idea of attempting to solve the problem which then engaged the attention of the entire industrial world.

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<sup>(1)</sup> William Grevel—"The Origin of the Iron Industry in the Diocese of Essen," and, "The Origin of the Fabrication of Cast-Steel in the District of Essen."

<sup>(2)</sup> In 1791, Friedrich Krupp's parents lived in the house, No. 9 Flaxmarket, which they had themselves built. The house still bears their names in iron letters; on one side, "F. W. P. Krupp," and the date "1791," on the other, "P. Forsthoff," over the side door on the right of the house are cut out in sandstone the arms of the Krupp family; on the sinister field, a serpent winding from the ground upward around a tree, (this movement is called "*kruppen*," and Alfred Krupp, supported by family tradition, connected the name with this device), on the dexter field, two elk couchant under a tree.

About the middle of the Eighteenth century, England had acquired the art of making cast-steel <sup>(1)</sup> and this carefully guarded secret gave her a decided advantage over the iron industry of the Ruhr district.

The resulting dependence upon the foreign product, became unbearable at the time when Napoleon's Embargo cut off entirely the supply of cast-steel, the only material which it was possible to use in the fabrication of the finer grade of tools. With restless perseverance, German experts endeavored to master the secret, but long without success.

At the "Good Hope" furnace, Friedrich Krupp met Gottlob Jacobi, a well-known engineer, who had for years studied this subject, and was induced by him to assist in the attempt to solve the problem. Together they made the first experiments at the Sterkrade Works.

After the sale of this furnace, Friedrich Krupp independently and persistently, continued to experiment at Essen. Dating from 1810, he had, north-east of the town, between Essen and Altenessen, near the present Segeroth cemetery, a small water-driven forging plant. There he worked with tireless energy at his self-imposed life-work, the introduction and perfection of cast-steel.

Relatives still living, who knew this forerunner of his more fortunate son, characterize him as a man of iron will, self-denying and austere, often gloomy and despondent over the non-success of his efforts. At last, his genius triumphed, his restless labors were crowned with success; he unearthed the secret of making cast-steel.

In the year 1815 he went into partnership with a

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(1) It is claimed that cast-steel originated in Sheffield, but according to William Grevel, Westphalian papers of that time maintain that a certain Bertram, who had decided to seek his fortune across the seas and was shipwrecked on the British coast, taught the English the process of making cast-steel.

man who had also worked in the same field, Friedrich Nicolai, a machinist, to whom, in the same year, had been granted, by Government authority, the exclusive privilege of producing cast-steel in the royal Prussian provinces between the Elbe and the Rhine.

Nicolai and Krupp made the following announcement in the *Essen News* of November 22d, 1815:

*“The undersigned herewith make known that they have formed a partnership for the manufacture of cast-steel. Referring to the announcement of July 1st of the present year, made by the senior member of the Firm concerning the Royal Prussian concession granted him, they now give notice that they have made the necessary arrangements for the manufacture of cast-steel, and are prepared to receive and execute orders. The price at the Works of welding, as well as of non-welding, cast-steel, is fixed for the present at 6 Silber-groschen cash, with Berlin exchange, per Cologne pound, for thicknesses varying from  $\frac{1}{2}$  in. to 3 inches.*

*Metal under  $\frac{1}{2}$  in. at proportionally higher price.*

*Small specimens will be sent without charge upon post-paid request.*

*Orders for less than 25 pounds will not be received.*

*Essen on the Ruhr, Nov. 22d, 1815.*

*Nicolai & Krupp.”*

In 1816, immediately after entering into partnership with Nicolai, Krupp established in the western part of Essen, about twenty minutes' walk from the nearest dwellings, a small plant, which in connection with the hammer already mentioned, a hammer by the way, that even under Alfred Krupp's management was for years the only one in use, served to fill current small orders. The connection with Nicolai, however, did not prove a success. The new partner knew little about the commercial production of cast-steel, and possessed a tempera-

ment unfitting him for amicable co-operation. Krupp soon dissolved the partnership, paying the considerable forfeit provided under their contract. Notwithstanding this, Nicolai, imagining himself wronged, commenced a suit against Krupp, which, though harrassing and annoying in many ways, was finally decided by all the law-courts in favor of the defendant.

In an official report upon the Krupp output, dated 1822, it is stated that "after weary years of experiment, after great sacrifices, Mr. Friedrich Krupp has so far succeeded that his cast-steel is in general preferred to the English." The report adds that the Krupp product "has been carefully examined by the Bureau of Manufactures and Commerce at Berlin and has been found, in adaptability and intrinsic excellence, fully equal to the best English steel, in some respects, even preferable."

But Friedrich Krupp was not to enjoy the substantial fruits of his labor; pecuniary reward was denied him. Although his product was found to be excellent for certain purposes, such as mint-dies, stamps for buttons, &c, yet the demand was limited, not sufficient to keep his Works going. The newly established plant was threatened with ruin; though more and more money was sunk, the inevitable current could not be stemmed. Early in the "twenties," Friedrich Krupp was compelled to give up his house in Limbecker street, and to occupy poverty-stricken laborer's quarters near his plant, a small one-story cottage, which is still preserved in gratified reverence, in the very midst of the present gigantic establishment, and which gives a better idea of the high standing and genius for work of the founder of the Works, than marble tablets, praises and eulogies could convey.

From this very cottage, on July 18th, 1887, the founder's great son, Alfred Krupp, was carried to his last resting place.

In the long struggle to reach his self-appointed goal, Friedrich Krupp sacrificed both life and fortune. Broken by sorrow, abandoned by hope, he died October 8th, 1826, at the early age of thirty-nine, and was buried in the church-yard on Weber street. As the city has grown, it has absorbed this burying ground, and with it, the grave of Krupp.

In August, 1808, Friedrich had married Therese, daughter of a merchant, John Peter Wilhelmi, who survived him. Their eldest son was Alfred Krupp. There were also three other children, Ida, an older sister, who died many years ago, and two younger brothers, Hermann and Friedrich. The former was actively associated with his older brother until 1848, when he entered extensively into the manufacture of white metal at Vienna—an industry which since his decease a few years ago, has been carried on by his sons. Friedrich is still living at Bonn.

At the time of his father's death Alfred (or, rather, *Alfried* for so he was named for the founder and patron saint of the city, *Alfried* von Hildesheim, so baptized, and always so called by his family,) was but fourteen years old. His father must have divined the potential capability and energy in the boy, for in his will he directed that the child, scarcely out of knickerbockers, should assume the management of the Works. Shortly before his death, Friedrich had confided to his son the secret of making cast-steel, and thus bequeathed to him as a most sacred legacy, the duty of carrying on the life-work of his father.

Up to this time, Alfred had been a pupil at the grammar school. At his own home he had seen nothing but strict devotion to duty, anxious cares, and indomitable application—the fruits of these qualities, his genius and energy were to gather. Both in mind and body, he was

precocious, it had now become his duty, at an age when his companions were still at play, to take upon himself a heavy, exhausting, care-engendering burden. In this his wise, active, energetic mother was his main-stay. From her he inherited, as he often acknowledged in after days, when speaking of her with profound reverence and deepest affection, his restless application and perseverance, the qualities to which he so greatly owed his success. Under the will, she was to carry on the Works under Alfred's management, and the Firm name was retained by them in honor of the departed husband and father.

In October 1826, in the papers of the time, Therese Krupp announced the continuation of the work, under direction of her son Alfred, in the following terms :

*"I have the honor to announce to the valued patrons of my deceased husband, that his early death has not resulted in the loss of the secret of making cast-steel, for through his foresight, it is now in possession of our eldest son, who had been for some time engaged at the Works under the direction of his father.*

*With him, I shall continue the business under the Firm name "Friedrich Krupp," and shall endeavor to give no occasion for complaint as to the quality of the cast-steel, or of the finished products.*

*The following will be manufactured at the Works ; Cast-steel in rods of any thickness, rolled plate and forgings after drawings or models, such as mint-dies, shaftings, spindles, shear-blades, rolls, &c., also tanners' tools.*

*Cast-Steel Works near Essen, October, 1826,*

*Therese Krupp."*

No rosy prospect unfolded before the eyes of this boy, thus early entering upon life's active work. Entirely without means, he stood by the ruins of a work which had brought to his father only anxious, unrecom-

pensed cares. He entered upon an industry which had exacted from his father, under far more favorable circumstances, both fortune and health.

As the son of one of the wealthiest families of Essen, he had once enjoyed his young life, now, before him lay only a future of self-denial and hopeless labor—a sad forecast, eliciting the pity of his companions.

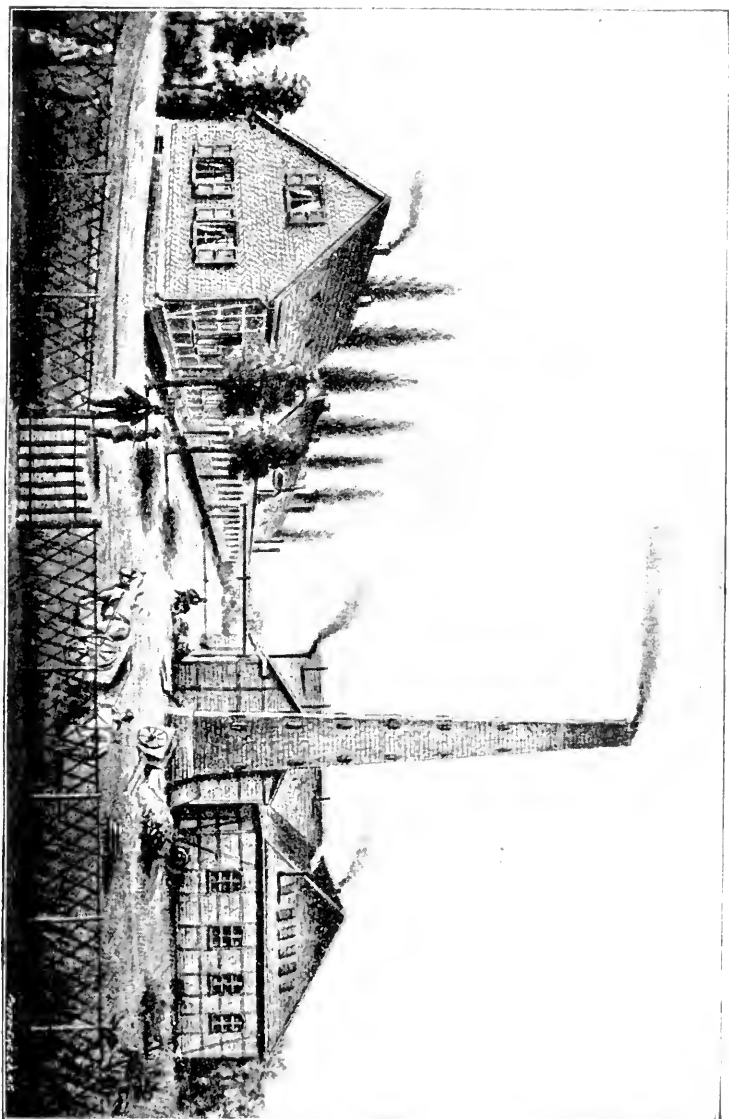
In after years, Alfred Krupp often spoke of the influence upon his disposition, of having heard people at the time of his father's death discuss, sometimes sorrowfully, sometimes with malicious satisfaction, the sad plight and fate of the erst fortunate family, and confessed that these comments had much to do with the development of his self-reliant characteristics.

With astounding energy and self-abnegation, this boy, just released from school, took hold of the work begun by his father. His activity was evinced in hard manual labor. With two workmen, increased to five in succeeding years, he carried on the forge, clad in overalls he stood at the anvil, from morn till night—the first to come, the last to leave, with calloused hands, swinging the sledge.

Even in the following decades, after success had crowned his efforts, the owner of the Works was still the first on hand at early morn, and often his assistants were obliged to remain with him till late at night.

Our illustration depicts the Works as they appeared when, in 1826, Alfred Krupp took charge; on the right hand, the shop building; on the left, the little one-story cottage, the so-called "Homestead," into which the family moved in 1822, in which Alfred Krupp lived until 1852, and which is still religiously preserved in the very midst of the present vast establishment, an idea of whose development from 1826 to 1888 may be gained from the illustration which appears as the frontispiece to the second part of this book.





VIEW OF KRUPP'S STEEL WORKS IN 1826.



Alfred Krupp himself, gives an account of the beginning of his work in the following words :

“I had had a riding pony since I was seven years old, but after my father had sunk his large fortune in the pursuit of his life-long search, when I was only ten everything was changed, and we moved into this little house.

In 1826, on the death of my father, from a broken heart, when he was but thirty-nine years old, I was directed by his will, at an age when my playfellows were entering the third class at school, to carry on his Works on behalf of my mother, and this without, on my part, knowledge, experience, strength, capital or credit.

Working hard, often all night long, my food being for the most part, potatoes, coffee, bread and butter, but no meat, I felt all the responsibility of a harrassed father of a family. For twenty-five years I persevered, until at last, under gradually improving circumstances, I conquered a decent living. My most vivid impression of the distant past, is the recollection of the long continued, ever threatening danger of ruin, and its avoidance through patience, self denial and labor.

With this I am anxious to encourage every young man who has nothing, is nobody, and wants to be something.

I found myself, as my father's heir, in charge of a moribund industry, with a few workmen at my side.

The daily pay of smiths and melters had been increased from eighteen stivers to seven and a half silber-groschen, (about eighteen cents) and the entire week's wages amounted to one Thaler fifteen silber-groschen (\$1 08). For a period of fifteen years, I earned just enough to pay my workmen their wages, for my own labor I had no other recompense than the consciousness of duty done.”

Working hard all day in the sweat of his brow, at the foundry, in front of the furnace, forging and casting, with evening his mental toil began, then he became engineer and man of affairs.

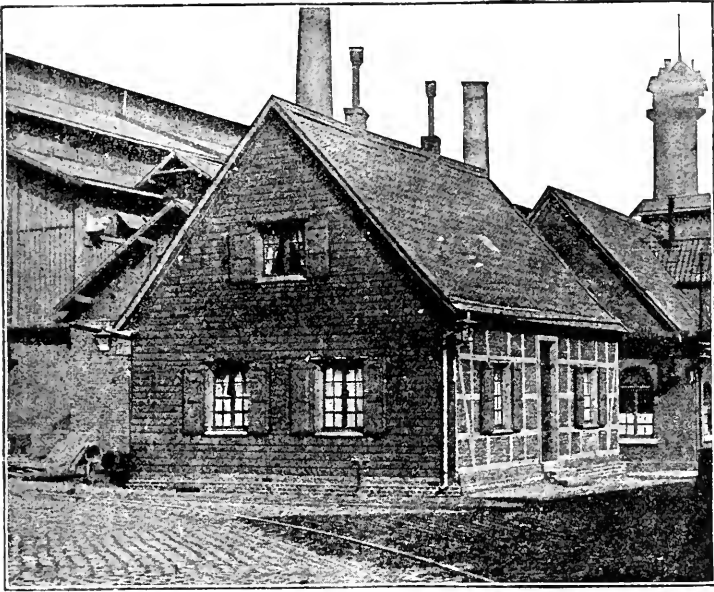
There he continued with zeal, his father's efforts to improve the manufacture of cast-steel—his inventive genius ever occupied in this direction. unceasingly striving to improve his output.

During this time, he did not neglect his commercial education, in the first years after leaving school, under the direction of his uncle, Charles Schulz, his father's friend, who for a long period remained his most faithful adviser, he devoted his Sundays to the study of book-keeping and to the acquirement of other mercantile knowledge. Notwithstanding these efforts, for many years his reward for this life of hard work was less than that now received by any one of the thousands of mechanics employed in the vast establishment.

Want, privation, hours of carking care, dwelt in that little home, want and care such as to-day—thanks to the paternal interest of Alfred Krupp—not an employee of the establishment need endure.

Having himself experienced in these years, the bitterest pressure of a workman's life, in happier years, Alfred Krupp continually strove to better the condition of the wage-earner, and his success in this effort places his name higher on the roll of fame than all his industrial achievements.

Alfred Krupp's humane, noble and filial disposition is shown by the eloquent, soulful inscription which he placed upon an engraving of the "little homestead," in 1873, long after he had reached the zenith of his fame, and which he distributed among his workmen.



“ Fifty years ago this laborer's cot was the refuge of my parents. May no workman of ours ever experience the sorrow that then enshrouded us! For twenty-five years, the issue was in doubt, an issue which has since then by degrees, so astonishingly rewarded the privations, the struggles, the confidence and the perseverance of the past. May this example stimulate others in distress, may it increase the respect for small domiciles and the sympathy for the greater cares that often dwell therein. ‘The goal of labor should be the common good—for then labor brings blessing, for then to labor is to pray!’

May each one of us, from the highest to the lowest, with like conviction, strive to found and to secure his fortune, gratefully, modestly. Thus would my highest wish be fulfilled.

Essen, February, 1873.

ALFRED KRUPP.”

At the beginning, the output was limited to tools, tanners' scrapers, mint-rolls and dies, shears, &c., whose excellence was every-where recognized with praise.

The Dusseldorf Mint was one of the main customers. Alfred Krupp himself used to deliver the completed dies at Dusseldorf, in order to receive immediate payment. The cash was often at so low an ebb that he had trouble in paying postage due on letters received. During the "thirties," the Austrian Mint gave him orders, but only after he had overcome the intrigues and chicanery of his Austrian competitors, who employed all means, proper and improper, to prevent the intrusion of the foreigner. Krupp lived for months in Vienna, in order to smooth the way. The determined opposition of his rivals caused him much suffering. In later days, when the beautiful dark curly hair which adorned his head, began so early to whiten, he used to say, "I left the color in Vienna."

At the very beginning of his activity, he characteristically and eagerly endeavored to make everything required in the Works himself. In these gloomy years, he always deemed it an especially gratifying achievement, of which he at once gave due notice to his men, when he succeeded in enrolling any means to an end, were it even the least important tool, among the list of his products.

The great scale upon which he carried out, in later years, the self-manufacturing system, is well-known. To-day there exist few branches of trade or manufacture which are not, in some way or other, represented in the establishment. Slowly but surely, the development of the Works went on. In the year 1832 Krupp stood in the midst of ten workmen. The financial backing of devoted relatives and friends enabled him gradually to get some good out of his inventions.

His first and most important invention of this time

was the cast-steel roller-die, for which he received patents in Germany, England and France. By the sale of his English patent, Krupp received the first reward worth mentioning for his continued labor, a reward that enabled him considerably to enlarge his Works.

In order to get as much benefit from his invention as possible, he formed a co-partnership with an Austrian merchant named Schoeller and in 1844, established a hardware factory at Berndorf, near Leobersdorf, under the firm name of "Krupp & Schoeller". This was placed under the immediate management of his younger brother Hermann, who up to that time, had been employed at the Essen Works.

During these years, Alfred Krupp undertook various extensive journeys, for the purpose of enlarging his knowledge of steel and iron fabrication. He stayed for some time in England, thoroughly informing himself on the standing of English metallurgical industry, patiently familiarizing himself with all the details of production and manufacture, and returning to his work, enriched by many and various experiences which he proceeded at once to utilize.

While in England, he made suitable arrangements in regard to the foreign sales of his output, which still remain in operation.

At home he formed connections with all prominent technical experts for exchange of experience, and thus acquired a scientific basis of astounding scope and variety for his inventive genius.

From the "forties" also date Krupp's endeavors to make cast-steel guns. In the year 1847, he sent a three-pounder muzzle-loading gun to Berlin, where it remained without notice until the Ordnance Board, in 1849, acknowledged the excellent quality of the metal. Orders, however, were not yet talked of.

In the beginning of 1848, his brother Friedrich left the Works, and on February 24th, 1848, Alfred Krupp assumed entire control. It was an unpropitious period; the agricultural depression which at that time, on account of harrassing political circumstances, was prevalent in all civilized countries, threatened the Krupp Works with ruin.

The number of operatives which in 1845 had risen to one hundred and twenty-two, this year, sank to seventy-two. To prevent still further reduction, Krupp was compelled, after he had exhausted both capital and credit in keeping the Works going, to melt down what remaining plate the family possessed, and with the money thus raised, he tided over this darkest period. The crisis was, however, of but short duration.

After the unfortunate year 1848, all German industries were powerfully stimulated in competition with English and French products, and in the forefront of the patriotic combatants, who were striving with foreign opponents for recognition in the markets of the world, stood Alfred Krupp.

The complete commercial independence obtained by him, in assuming the sole control of the Works in 1848, had a most important bearing upon so self-reliant a man. Indeed such sole responsibility was an indispensable requirement for the full development of his mental power. Now that his genius was unfettered, his far-seeing eye often discovered paths through which others dared not follow him, shrinking from threatening obstacles, seemingly insurmountable, and deeming the invisible goal, unattainable.

A nature like Krupp's must be untrammelled, absolutely free to do and to act, for its highest possible development; it must bear the entire burden of responsibility for the evolution of the required strength.



A few figures will make clear the astounding advance of the Works in the succeeding years, an advance that might be typified by an increasing Arithmetical Progression with an almost incredible annual difference.

In the year 1848, seventy-two workmen were employed. The series up to 1865 is as follows :

|           |       |           |       |
|-----------|-------|-----------|-------|
| 1849..... | 107   | 1860..... | 1,764 |
| 1850..... | 237   | 1861..... | 2,082 |
| 1852..... | 340   | 1862..... | 2,512 |
| 1855..... | 693   | 1863..... | 4,185 |
| 1856..... | 970   | 1864..... | 6,693 |
| 1858..... | 1,047 | 1865..... | 8,187 |
| 1859..... | 1,391 |           |       |

These numbers are eloquent testimony ; they show the unexampled progress, the final success of Alfred Krupp's untiring labors, the just result of the force of his genius in the field of manufactures.

No later period in the history of the Works, has been so marked by revolutionizing inventions as is the decade between 1850 and 1860. They were the results of the extended studies and investigations undertaken by Alfred Krupp in the previous ten years both at home and abroad, and ingeniously embodied the experiences gained during these years.

The London Exhibition of 1851, offered the first opportunity for the world to become cognizant of the creative genius of a man who had been destined to bring to a victorious close, the struggle between German and foreign iron and steel makers.

Krupp had already received the Prussian gold medal for his exhibit at Berlin in 1844, and had thereby attracted the attention of some of his countrymen, but beyond the narrowest and most intimate home limits, there was no thought of what was going on in the little

country town on the Ruhr, no thought of what a workman, hammer in hand, was there preparing, none dreamed that out of a laborer's cot, stern circumstance had developed a character and genius, capable of crushing foreign manufacturing monopoly.

How many had heard so much as the name, Essen? Possibly one or another may have recalled hearing of the small-arm factory which had flourished there during the middle of the eighteenth century—was there aught else in the harmless little country town to raise nations' hopes or to start their fears?

Krupp appeared at the London Exhibition with the products of his establishment. While it might have been considered possible under most fortunate circumstances to cast steel ingots weighing *twenty*-hundred weight, Krupp exhibited a steel block weighing forty-five!

The resulting evident possibility of utilizing cast-steel in large quantities and for heavier parts was a matter of paramount manufacturing importance. Heretofore, cast-steel had been made in England only in small masses, suitable for tools, especially for shears, knives &c. Hence the astonishment of the assembled metallurgists at the sight of Krupp's huge steel block. English steel makers did not know what to make of this result of German workmanship—they, the undisputed leaders in iron working, beaten by a German!

Intense excitement pervaded the interested community. The Krupp block was the centre of attraction at the Exhibition. From far and near, came people to gaze upon this wonder of steel production; some English papers even went so far as to announce "there is some deception in this, something unfair."

Krupp's statement, that his cast-steel could be forged, was received with incredulity. It was believed

that this metal, like cast-iron, raised to forging heat, would be shattered to atoms under the hammer.

A piece of steel was cut from out of Krupp's ingot, raised to a proper heat, and forged on the anvil in all directions. With this palpable proof, Krupp's success was complete.

Alfred Krupp alone, received for his work the "Council Medal"—at a touch, his world-wide reputation was established.

The patient workman in overalls had become one of the most celebrated manufacturers in the world. A success beyond compare, a success of labor, both manual and mental, by itself proving how mighty that labor had been.

In 1852, Krupp invented a method of manufacturing weldless railroad tires, an ingenious and simple process, an invention whose extraordinary pecuniary success enabled him to utilize the experience he had gained, upon a grand scale, to establish great shops and to set up powerful machinery, absolutely necessary to the exhaustive application of his hard-earned knowledge.

Up to this time, railroad tires had been made by bending an iron or puddled steel bar about the circumference of the wheels and welding the ends. This most natural way of making an iron ring, was open to the objection that the tire was liable to open at the seam, to become fractured and thus readily to cause serious accidents. Krupp took a cylindrical mass of steel in which two longitudinal holes were bored, afterwards united by slotting. The cylinder was then spread by drifting, thus forming a closed ring, without weld, a ring equally strong at every point of its circumference. This ring is further so finished that it may be shrunk upon the wheel. This invention was at once patented

in all civilized countries. Wheels, tires and other railroad supplies, after the London Exhibition, became the principal output of the Works.

Alfred Krupp was now at the head of a world-renowned plant, and yet this simple unassuming man, the employer of four hundred men, still lived (in 1852) in his one-story cottage.

In 1850 the death of his mother had occurred—a mother who had, during the dark and dismal days of the beginning of his work, so loyally and steadfastly held up the hands of her son. Of her, he constantly spoke, in after years, with the deepest love and reverence. She was buried in the “Old Church-yard,” and not far from her, her beloved son reposes. After a hard life’s work, holding many hours of care and sorrow, which they bore together, they sleep peacefully—and not apart.

Not until 1853, did the head of the Works leave the little home in which he had known such cares and sorrows, and occupy a more commodious dwelling, which he built immediately adjoining his old-time home. This *new* home was a very unpretentious two-story house in which he lived until the year 1860. In 1853, Alfred married Bertha Eichhoff, daughter of a Treasury official in Cologne. On the 17th of February, 1854, a son, Friedrich Alfred Krupp, the present owner of the Works, was born to them.

Scarcely had Krupp conquered for himself an assured livelihood, scarcely had he emerged from surroundings of the bitterest need and care, when he at once turned his attention to the condition of his workmen, and made the bettering of it his first thought and interest. He had only just exchanged the tiny and simple home of which we have heard, for a more com-

fortable dwelling, when he began to plan the securing of more comfortable dwellings for his workmen of all grades.

As soon as the Works began to expand, in 1851, he at once manifested the greatest interest in the physical and mental health of his workmen, and actively continued it to the very end of his useful life.

In 1853, he founded the Sick and Pension Fund, for the aid and protection of the disabled workmen.

The rapid increase of the Works and the resulting enormous influx of population was attended by a series of evils, which he met most effectively in the workmen's interest. The natural results of the starting up of an enormous industry are : insufficient shelter, increase of rent, and a general rise in price of the necessities of life. Hordes of hucksters and small dealers took possession of the workmen's quarter of the town, *not* for the benefit of their customers.

“ The major part of the newly started business was of the insignificant ‘ corner grocery ’ order, established on the ways from workshops to dwelling places. Unprincipled offers of credit served as baits, for the workmen did not stop to think that they frequently received poor stuff, and always at exorbitant rates.

Once within the clutches of an extortionate huckster, it was with the greatest difficulty that they could free themselves from his grasp. The suit for debt, which was threatened, bound them to their remorseless creditor, to whom they were often compelled to pay usurious interest.

Not less than to these petty dealers, the workman fell a prey to the saloons, which sprang up about him like mushrooms, seeming more attractive than his crowded, uncomfortable home ; and his many vexations, many sorrows, he sought to drown in beer and whiskey.”

Under the pressure of these surroundings, Alfred Krupp's ideas, in regard to the improvement of the workmen's condition, were evolved, and in realizing them, he solved for his own community a great social question—that is so far as, in view of the requirements of modern social order and of modern conditions of manufacture, it admits of solution.

A conception of the squalor and unhappiness of these times may be obtained when we learn that, for instance, in the Ward "Holy Ghost," 2,962 individuals lived in 124 houses, an average of twenty-four souls to each small house! Krupp's methods for the amelioration of these evils, and for the general improvement of the people, his arrangements for the common welfare and his rules for the social government of his employees, are as theoretically promising as they are practically successful.

They attest not only Alfred Krupp's humanity, his ardent sympathy for the working classes, but also his clear conception of social questions, and his creative power in meeting them. Long before the State acknowledged that legislation upon social conditions was one of its most important duties, we find Alfred Krupp, within his own community, in his own workshops, entering upon that method of treating the pressing social questions of the day, afterwards so successfully followed in their solution by the great Chancellor.

Alfred Krupp and *his* workmen did not require the restraints and safeguards of legislation. his philanthropic heart, his sympathetic soul, formulated the conditions under which a generous employer cares for the moral and material welfare of those under him.

Sick-funds, accident insurance, and retiring pensions, were all established in the "kingdom" of Krupp, long before an Imperial proclamation made known to the

whole world of labor, the blessings of such institutions.

The actual existence of these arrangements within Krupp's Establishment, convinced the political economists of their general practicability ; though inseparable from their success is the cheerful spirit of concession, always shown by Krupp, in the granting of workmen's righteous demands.

The first thing to be done was to free the workman from the exactions of usurers and speculators who were draining him of the greater part of his earnings.

He was to receive all the necessities of life, of good quality, and at low price, at the same time he was to be prevented from running thoughtlessly into debt. This result Krupp reached by the establishment of a *Commissariat*, or regular supply system. As early as 1858, he erected a bakery, in 1868, groceries were added, 1871, boots and shoes, 1872, dry goods, haberdashery, and tailoring ; a mineral water factory, a hotel and beer saloons, 1875, an abattoir and a meat market. Every thing was sold to workmen at cost, but for cash only.

The men hailed these arrangements with delight, they soon saw the advantages that accrued, year by year the patronage increased, and the occupation of the hucksters near the Works, was almost entirely gone. While the business community naturally considered this species of "direct supply" stores as interfering with their pursuits, yet for the wage-earner, the creation of cheap sources of supply was a blessing.

No measure, affecting the social welfare of the great mass of a people, can be carried out without clashing with individual interests.

He who endeavors to accomplish the greatest good for the greatest number, fulfills the highest duty imposed upon us—even if in his endeavors, apparent injustice may here and there ensue therefrom. To solve

the pressing problem of domiciles, Krupp sought to provide his workmen with good and healthy dwelling places, and consequently, with comfortable home life. A workman should be contented in the bosom of his family, at home, and feel no yearning for garish saloon life. This conviction animated and inspired all Krupp's efforts.

He built, with funds drawn from the Works, roomy, and, in accordance with the requirements of sanitary principles, *well-drained* houses, and let them to his employees at considerably less rental than had hitherto been paid for the miserable dens in which they lived. A row of these buildings was put up in the "fifties," and in 1863, the settlement "West End" was already established with forty buildings and one hundred and forty tenements.

At present the Works have, with the settlements "Schederhof" and "Kronenberg," 3,208 suitable and healthy family tenements, harboring, all told, about 16,200 souls. All these tenements are supplied with water.

To provide for the unmarried, and for those who had left their families at home, a "Commons" was erected, in 1856, for 200 persons, and appropriate board furnished them at moderate cost.

To the philanthropic measures of later years—hospitals for general and contagious diseases, life insurance association, hygienic provisions, &c., we shall recur again.

Meanwhile the Works were extending year by year, constantly was Krupp, by some new invention or improvement, giving increased scope to his output, and carrying out on the greatest scale, the new plans for new work which his daring, enterprising spirit was perpetually devising.



The inevitable result, that hopes were sometimes crushed, that great losses occasionally once more brought anxiety, could not fetter his indomitable will. His clientage constantly increased, the Works continually expanded.

In 1858, ten hammers were in use, of a total weight of 370 hundred weight, even then insufficient for the work required.

In the same year was erected a 60,000 lb. hammer, with 10 feet fall, and driven by a 66 horse-power engine. More hammers were shortly added, also other industrial improvements, a roll-train, &c.

At this time, too, the giant stack, 230 feet high, 30 feet in diameter, which still towers above all the other chimneys of the Works, was built, and is even now, overtopped by but few in the world.

The Munich Exhibition of 1854, gained for Krupp's achievements the recognition and appreciation of Southern Germany. This exhibit was crowned with the memorial Gold Medal. The King of Wurtemberg deemed it proper to express his gratification to the exhibitor, and to award him "as a mark of His Majesty's estimation of the product of the Works," the larger Gold Medal for Science and Art.

The Paris Exposition of 1855 brought fresh triumphs. The cast-steel block exhibited was more than double the weight of that of 1851. It weighed 5,000 kilograms, and evoked the same astonished admiration that had been manifested at the London Exhibition. Practical evidence of this appreciation was given by the award of the large Gold Medal. The 12-pounder shell gun exhibited, so engaged the interest of the French, that exhaustive trials with Krupp guns, which Krupp attended in person, were instituted. How little did they then dream of the direful harm this man's cannon would

one day work them ! The trials, however, did not lead to an order, and in fact, with the exception of some experimental pieces, Krupp never delivered a gun to the French.

In the following years, the gifted proprietor received as guests, both at the Works and in his modest, hospitable home, high functionaries and royal personages.

June 30th, 1858, he exhibited his work to the former Imperial Regent, the aged Archduke John of Austria, and on July 24th of the same year, to von Waldersee, Prussian Minister of War.

Two years later, King William I. of Prussia, who had in 1853, as Prince of Prussia, examined the Works with deep interest, visited Essen for the second time, to behold with wonder the enormous progress of the plant. Since that time, the rulers of all civilized countries, Emperors, Kings, Princes, the leaders in the world of Industry, Art and Science, have sought at his work, this man of the people, and have partaken of his hospitality.

All who came, stood dazed and wondering before the vast work, stood dazed and wondering before the plain and unassuming man, of dauntless spirit and power, who had created it.

The court of the ‘‘Cannon King’’ was tacitly counted among the European courts. A motley picture of international intercourse frequently developed itself here on neutral ground, when the representatives of almost every civilized State, met, in order to have forged, cannon with which to do battle each with the other.

Though Krupp, with his stately presence, was a peer of Princes, yet he ever preserved the disposition of a man of the people.

He was overwhelmed with acknowledgments. Honors and Orders, without number, were conferred upon him. Few men ever received more decorations. and yet he

was hardly seen wearing an Order on his breast. Honors, Titles, Orders, were of little value to him, he insisted upon being addressed always as "Mr. Krupp."

His individuality impressed without adventitious aid, and he remained ever the simple citizen, the first workman in his establishment.

In 1864, having been approached in regard to his acceptance of a Title, he declined, preferring to retain his simple name, which, modest as he was, he must have known, had and will have for all time, a resonance, clear and powerful which no Title could enhance.

The pride of citizenship and of individual power, peals never more richly, more loudly, than in the sound of the word KRUPP.

In 1858, he had been nominated Councillor, and in 1861, the King, on the occasion of his second visit, personally named him a Privy Councillor.

Krupp's endeavors, in the "forties," to utilize cast-steel in the fabrication of ordnance, were naturally given up for the time on account of the enormous demand upon the Works during succeeding years for railroad supplies.

A secure foundation of prosperity was necessary before these endeavors could be resumed.

Not until the close of the "fifties," was Krupp able again to devote his full attention to this branch of activity; but since that time, he has given full rein to his inexhaustible inventive genius, and reached results in Ordnance science which have had decisive influence upon the development of our military system during the last decades. Here too, he had many a difficulty to overcome, many a prejudice to fight down.

Gun construction was a foreign, more particularly an English, specialty; Alfred Krupp took up the gauntlet for home production, even in this branch of industry.

Before the adoption of his cast-steel breech-loading guns, success was not assured.

The first country to give Krupp an important order was Egypt, which in 1857 received twelve 12-pounders and six 24-pounders from the Works, and in the following year an additional and greater number. The next year, Brunswick ordered seven 12-pounders, and at last Prussia, 23 finished and 277 unfinished 6-pounders.

The first important advance in Krupp's gun work, was contemporaneous with the adoption of the rifled breech-loader, a construction for which cast-steel was especially adapted.

In 1862, he exhibited at London, besides a muzzle-loader, 87 millimeters calibre and 297 kilograms weight, his first five breech-loading guns. From that time, year after year, the Krupp gun system has continually developed. Many important inventions and improvements were applied by Krupp, and with the progress of cast-steel making, the guns increased in size.

At Paris, in 1867, Krupp was represented by a 14-inch gun, weighing 50,000 kilograms, and lately he contributed a monster weapon weighing 120,000 kilograms, firing a projectile of 1,050 kilograms with a powder charge of 330 kilograms.<sup>(1)</sup> During his life, Krupp delivered a total of 23,000 guns to thirty-four different States.

After determining upon a suitable breech mechanism, Krupp devoted his attention to the method of construction, the body of the gun, the finishing of the bore, to carriages, and to projectiles.

He built the tubes of several layers, thus adding to their strength, and modified the interior arrangements of the bore, as determined by continued experiment.

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<sup>(1)</sup> NOTE.—We all recall Krupp's magnificent exhibit at our Centennial Exposition. It was sent over in one of the steamships belonging to the Firm, and all were impressed by the variety and scope of the output.

The monster 14 in. breech loading rifle, mounted upon its automatic recoil checking carriage, can never be forgotten by any one who saw it.

The bearing of the projectiles was improved, their weight, length and the charges were appropriately increased, percussion and time fuzes were designed and thoroughly tested. The standard models of carriages were improved, and in many respects entirely reconstructed.

Thus was born the Krupp system of ordnance, acknowledged to be the best in the world, which, by its simple and enduring constructions, its easy service and thorough accuracy, has gained a foot-hold in every quarter of the globe—the Ordnance system of the “Cannon King.”

“We owe it to the restless activity of the departed Chief Constructor of Ordnance of the day,” says the *Deutsche Heereszeitung*, “that first the Prussian, then the German, artillery could meet the foe with assured superiority.”

In 1861, Prussia adopted the Krupp rifled breech-loading gun. In the intrenchments, at Dueppel and at Alsen, the Krupp gun first spoke in thunder tones, proving its might in the hands of the Prussians,—here first did its part in achieving victory.

The war of 1866 did not add new laurels for the Krupp guns. The Prussian artillery played no important part in this bloody drama, and the efficiency of its weapons, in the most important battles, was disappointing. A crisis came as regarded Krupp's guns. A heated debate was carried on by experts in regard to the adaptability of rifled breech-loaders for field service.

But in Berlin, in the authoritative circle, the conviction of the superiority of the Krupp breech-loading system remained unshaken; eight hundred and twenty-six guns of various calibres were ordered during the same year, and at the re-formation of the IX, X and XI Army corps, the batteries were supplied with Krupp guns.

General von Voigts-Rhetz, later one of Alfred Krupp's most intimate friends, was especially active in agitating for the retention and extension of the Krupp system.

The future justified his opinions. The *Deutsche Heereszeitung* to-day, does honor to Krupp's tactical genius, in proving that the unfavorable artillery results of the war of 1866, were not due to the field-guns, even at that time recognized as admirable, but must be ascribed to the faulty organization of the field artillery.

"In these trying times, the decided opinion of Krupp, the artillery-man, not the gun constructor, had much weight in bringing about the triumph of the breech-loader."

England, at that time still in the lead, was compelled, *nolens volens*, to acknowledge that its great German rival was right. The superiority of the Krupp breech-loader, especially for naval and sea-coast service, in comparison with foreign systems of construction, was definitely proven at the great competitive trial between Krupp and Woolwich guns at the Tegel Proving Ground, near Berlin, in 1868.

The superiority of English guns, powder and projectiles, was undisputed at that time, even by Prussian Ordnance officers, not a single one of whom thought it possible that the German gun could come out ahead.

The result was astounding. Under all circumstances of trial, the Krupp guns retained the lead in accuracy and endurance.

The Krupp breech-loader drove the Woolwich muzzle-loader defeated from the field.

At present, the armament of German, Austro-Hungarian, Italian, and Russian field artillery is based on the Krupp system ; German field, naval, fortress and sea-coast guns consist, exclusively of the constructions, of the "Cannon King."

The whole world over, the Krupp gun is known and desired : when Servian and Bulgarian, Turk and Greek, do battle with each other, Krupp guns cast forth death and destruction to both sides ; when European powers undertake frontier defense, their fortresses bristle with Krupp guns ; even when wandering in Africa, sailing up the Nile, or in Asia, among the almond-eyed subjects of the Flowery Kingdom, Krupp guns bear grim witness to the progress of civilization.

But Krupp's greatest triumph was in the war of 1870-71—a triumph which has inscribed his name in imperishable characters upon the scroll of fame, and connected it forever with this most glorious epoch of German History.

Krupp guns thundered in every battle when German Unity was the stake. A brilliant justification awaited those in authority, who, notwithstanding the apparent failure of 1866, had clung to the Krupp system. The Krupp breech-loader achieved unparalleled success. The hitherto celebrated French Artillery “paled its ineffectual fires” before its German foes.

The Chassepot, on account of its greater range, was far superior to the needle-gun, and the German infantry would hardly have succeeded in so frequently defeating its far better armed opponents, had not the German Artillery, with its peerless Krupp guns, cleared the way.

A competent judge thus expresses himself in No. 207 of the *Rhenish-Westphalian Gazette* in regard to the share assignable to Krupp guns in the successful termination of the great war.

“Every artillery-man will recall the joyful satisfaction experienced, how the confidence in the superiority of his own weapon grew, from the very first encounter with French guns. The knowledge that they possessed a better gun, gave our artillery a feeling of security,

and on all occasions inspired them for active, enthusiastic, pushing work, often saving us many an anxious hour, and giving joyful confidence to our infantry, so hard pressed by the much superior Chassepot.

Frequently our artillery, with its Krupp guns, was enabled to pluck the laurels of the brunt of the fight from the infantry, to whom, usually, they were so gladly yielded. In this sense, Sedan was an artillery duel, the grandest of the century. On the day of Sedan, our national Thanksgiving day, our artillery, with its Krupp breech-loaders, celebrated its greatest triumph."

Krupp's deadly field pieces turned the scale at Gravelotte, and at most of the other great battles; Krupp's massive siege-guns thundered at Strasburg and at Paris: and gave their powerful aid in forcing capitulation.

So is the name of Alfred Krupp, written in golden blazonry among "the few, the immortal few, who were not born to die," who worked for Germany and German Unity, names that will be household words, so long as there is a being left to speak with German tongue.

Until the "sixties," the Works were exclusively engaged in the fabrication of crucible steel; subsequently the later processes of Bessemer and Martin were introduced, methods that brought about the more economical production of a large output, decidedly inferior in quality, however, to crucible steel. On this account, crucible steel, the real specialty of the Works, still remained the only gun metal.

Since this period, Krupp, in accordance with his plan which he, as already stated, had formed at the very founding of the Works, that of being independent of other manufacturers and the daily fluctuations in raw material, acquired ore beds, coal mines, and blast furnaces. To-day the entire amount of ore and coal con-



sumed is home supplied. The Firm owns not less than six hundred ore beds in Germany and in Spain (near Bilbao), eleven blast furnaces, some coal mines near Essen and Bochum, a number of smelting works on the Rhine and in the Westerwald, a series of stone quarries, clay and sand pits, and an extensive proving ground at Meppen, nearly ten miles long. Four steamers, of 1,700 tons each, serve for the transportation of the Spanish ores to the Firm's blast furnaces.

In all this immense progress and success, Alfred Krupp allotted his employees an intrinsic share. The great praise vouchsafed to his products, gave him repeatedly the opportunity of offering his workmen, after weary weeks of labor, rest and recreation.

Above and beyond all, simultaneously with every step of progress, with every increase of scope, his efforts to better the circumstances of his people grew.

“ Every manufacturing establishment should, my Works *must*, insure the health and prosperity of all concerned. With assured and sufficient earnings, with content and comfort at home, every individual can enjoy the very fact of living.”

This was the very corner-stone of Alfred Krupp's business belief, and he lived up to it. The arrangements for the general well-being, already described, were improved and extended ; many other additional measures for the same purpose were put in practice. To-day the supply department embraces everything needed in daily life. New regulations for the government and administration of the Sick, Pension, and Widows' Funds, have been formulated. In 1871, a general hospital was erected, in 1872, one for contagious diseases. In 1874, a bathing establishment was built, with individual bath-rooms and a Russian bath.

The Life Insurance Company instituted in 1874 now

numbers 2,000 policy holders. To give work to invalids and convalescents, who were not fit for regular shop duties, brush, and paper-bag, making, and other light employments were undertaken in the interest of the Supply Department.

Krupp interested himself not only in the bodily comfort and health of his people, but also in their mental development.

Four large public schools were turned over free of cost to the new communities ; in addition, a non-sectarian private school with seventeen forms was erected.

To make good housekeepers of the wives and daughters of his workmen, to awaken and to train their sense of order, their desire for active usefulness, he built two industrial schools at Essen, in the year 1875, and three in Kronenberg and Schederhof.

The evening schools at Essen and Altenessen were endowed and supported ; and every apprentice was required to attend them. Krupp had therefore the right, in 1877 thus to address his workmen:

“ To better the conditions of my employees, my earnest endeavor, from the very beginning, was to insure that when the time came when they could no longer work, a comfortable existence was still before them. You yourselves best know how the sick, the aged are treated by us. I have built houses for you, sheltering at this time, 20,000 souls ; I have founded schools, made donations, instituted measures for the economical supply of every thing required in your daily home life. In return, I ask but one thing, that each one, do his duty and live up to our regulations.”

Krupp did not let his charity stop at his own Works. Many were the people aided and led on to prosperity by him. He dried many a tear, relieved many a need. The Golden Rule was his guiding principle.

A new proof, were one wanted, of his care for the welfare of his people is offered in the magnificent, almost princely, legacy, which he bequeathed through his son to his employees, for which they must be filled with gratitude to both father and son. <sup>(1)</sup>

In 1860, Krupp gave up the modest dwelling built in 1852 beside the "home," and removed to a roomy house, also within the Works, surrounded by lawns and parterres, the so-called "Garden home," in which also lived his son, Friedrich Alfred Krupp, during the first year of his marriage with the Baroness Margerethe von Ende.

Alfred Krupp lived here until 1864, when he purchased a small country home near Bredeney. It was built upon a wooded height rising from the Ruhr and enjoying a beautiful view of the valley of the river.

By degrees, he added more and more land, converted it into a magnificent park, and there built in 1870, a palatial residence, "Hill-side House," in which he lived until his death.

Even after Alfred Krupp had moved to Bredeney, and had ceased to dwell among his hammers and smoking chimneys, he still led all in active work. Up to 1871 and 1872, he could be seen daily, riding at early morn to his duties.

High and low were alike impressed as they recognized his stately figure riding through the Works, a hunting cap increasing the soldierly aspect, his bright searching eyes seeing everything, and their owner never failing to acknowledge the salute of even the most insignificant of his employees.

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<sup>(1)</sup> NOTE.—One Million Marks were set aside August 3rd, 1887, by Mr. F. A. Krupp, in compliance with his father's wish, for the benefit of all workmen connected with the establishment.

The interest is to be disbursed under direction of a committee of employees. A similar committee is to submit a project regarding the scope of application of the income. Mr. Krupp also presented to the city of Essen, 500,000 Marks "for charitable and general purposes."

About 1870 he began gradually to withdraw from the workshop and the active duties of the establishment. He had so far finished his life-work, that he was enabled to leave the administration and the carrying-out of details to men whom his keen insight into character had found worthy, and he had so arranged matters as to make this possible.

The talent for organizing, possessed by their great head, was an important factor in bringing the Krupp Works up to their high repute. He devised, for the administration of the complicated affairs of this establishment, busying over 20,000 people, a system worthy of serving as a model, its parts functioning one with another, all answering their purpose with the utmost exactness.

One note-worthy point in the study of this man's work was that, he planned and finished an undertaking that bore the strong impress of his remarkable personality, embodied his individuality, views, and principles, and yet was not dependent upon him alone for further usefulness and success.

Most great undertakings have been so much part of their founders that, the master-mind gone, the work also faded out of the world. Alfred Krupp is dead—but the Krupp Works, his noblest memorial, live.

Early in the "seventies," Krupp thus expressed himself in a legal proceeding in which the Works were concerned.

"I have intentionally withdrawn from the business arrangements of the Works, to such an extent as to demand their acquirement of the necessary self-reliance—so essential an element of lasting success."

Krupp shared with some few well-known master-minds, a most wonderful power of keen insight into human motives, the great gift of judging human char-

acter, enabling him to choose, unerringly, fit instruments for the execution of his plans. He gathered the best mechanics and business men from all parts of Germany, and unfailingly assigned the right man to the right place. To-day the Works possess a general staff of thoroughly able officials, under the leadership of a managing committee composed of technical, commercial, and legal experts, who have authority to act in the name of the Firm.

The present head, Friedrich Alfred Krupp, has for years taken an important part in the conduct of the business, as an active member of this committee, and has earned for himself, from officials and workmen, the same love and confidence given to his great father.

Until the very end, Krupp kept his keen eye upon everything, all general projects originated with him, numerous important and unimportant inventions, many of which, of course, never came to practical use, bear testimony to the restless activity of his inventive genius, to the last days of his life.

As an example of these inventions, only executed in model, we may cite his "Naval Pivot-Gun," a piece established on the flush deck of a low iron-clad. Nothing is exposed on the deck of the boat except this rotating gun, which is served from below by an absolutely protected and invisible crew,

Many of Krupp's instructions were written with pencil, in short trenchant words, on memorandum blocks. Most of his thinking and planning was done in the silence of the night, when brooding, ruminating thoughts robbed him of sleep, and many of his inventions were the outcome of midnight reflection. Pencil and paper were always kept on a table close to his bed—a sudden new idea was at once recorded, and tested the first thing in the morning.

He, himself, often told, that on one occasion when the mighty Eureka of one of his most important inventions, came thus to him, in the dead of night, paper and pencil were wanting, so he blackened the candle-stick plate, and, with a match, fixed his thoughts and sketches on the sooted surface.

Krupp held aloof from political turmoil. He concentrated himself upon the interests of his Works and hence was able to do so much—to carry his success so far. He not only avoided politics for himself, but he was averse to his employees taking part in political agitations.

“ Earnest, active interest in State politics, demands more time and a deeper study of complicated relations than is at your command. Besides, political hobnobbery is expensive, you can get better money’s worth at home. Your daily work finished, spend your time in your houses, with your parents, your wives and your children. There find your recreation, there reflect upon household matters and education—let this and your work constitute your politics—and thus enjoy contented lives.”

In this paternal fashion did he advise his people. He scrutinized sharply all insidious political influences, emanating from various quarters and having for their object the destruction of the contentment of his force, and the undermining of the confidence and love which he inspired to such an extraordinary degree.

He met such seditious efforts with admonishing words where confidence still existed, put them down with a firm hand, when necessary. His published addresses to his workmen were always couched in an earnest heart-appealing tone, for the words came straight from his heart. The paternal friend, not the proud owner, appealed to them.

In reading these addresses, appeals to the employees of the establishment, never wanting when danger was to be averted, plain forceful words, breathing loving care and manly determination; one can realize the impression they must have made, and can understand that Alfred Krupp's individuality must have made itself felt among his workmen, even among those who had never seen him, as a firm rock in the midst of the seething waters of unceasing deceitful machinations.

He expressed himself with such unequalled practical common-sense and convincing truth within the understanding of even the most insignificant; he imparted so clear and simple a conception of all social questions, that the blatant mouthings of unprincipled agitators lost their effect, he drove them before him from the field.

His hearers, even if unsympathetic at first, were compelled to admit,—Here is Truth and Unselfishness, there—Deceit and Egoism.

“I wish to be understood by every one, man and woman, educated and uneducated, therefore I use plain, homely German.” So begins one of his addresses.

“Mutual loyalty has made our work great.” For the first time Alfred Krupp saw this loyalty endangered, in 1872, at a time when the reckless agitations of “social-democratic” and “ultramontane-socialistic” demagogues threatened the peace and unity that had dwelt so long among his people. Then he appealed to his workmen warningly, admonishingly:

“Before I have occasion to complain of disloyalty and resistance, let me warn you of the lot which irresponsible agitators and unprincipled sheets, under guise of benevolent intentions and by the misuse of religious and moral maxims, are trying to impose upon the great labor class.” He was then compelled to remind them of what he had done in their behalf: “As

the circumstances of the Works changed, as their growth increased, I gradually raised wages, as a rule, voluntarily, anticipating all reminders, and this course shall continue.

One useful measure after another has been introduced, and the tale is not ended, the most strenuous efforts have heretofore been made in the interests of the workmen; the dwellings now in course of construction, run up into the thousands."

Where in the world could less motive for "social democratic" agitation be found than in this great plant, where the solution of all social problems, and the improvement of the workman's condition, had been the life-study of the founder? Here, where countless measures for the common good had taken away all grounds for complaint on the workman's part, Alfred Krupp took up the fight against false socialistic doctrines and subdued them with the weapons of intelligence and deed-doing love.

In 1875, that his workmen might become familiar with the baneful spirit of social democracy, Krupp gave to each one of them, a book which made clear the real sources of social misery, stating them with a truth regardless of consequences.

He prefaced Friedrich Harkort's "*Arbeiter-Spiegel*" ("The Worker's Mirror.") with clear and incisive words, recommending this excellent work to his employees—"that they might take it to heart, as it clearly pictures the condition of Labor, the causes of its grievances, its rights and its wrongs, and points out the only path that leads to enduring welfare and happiness."

The agricultural depression of the following years with the resulting lowering of wages, again furnished social agitators with the fruitful soil of discontent.



The Reichstag election of 1877 offered renewed opportunity for goading on the workmen and for infecting them with the virus of discontent.

At the election, January 10th, the ultramontane-socialistic candidate polled 7,802 votes, the social-democratic 3,062. Then, in March, Krupp again issued at length "A Word to all connected with my Establishment." In this address, a model in form and substance, he enters with more detail into the aims of "social-democratic" effort, and makes known his own views on the labor question.

With all the convincing power of the plainest common-sense and practical experience of life, with incomparably simple, cumulative, incontrovertible deduction, he cuts away the ground of all theoretical calculations and chimerical projects.

Vividly and forcibly he depicts the character and the aims of those "new benefactors of the world" who, "in order, (when the time seems to them ripe for the overthrow of social systems) to obtain from the ranks of the helpless, willing tools with which to work out their selfish, rapacious ends, are, in the guise of guardians, striving to ruin the laborers."

The successful result of his fight against the false doctrines, which threatened the peace of society, is well known.

Social democracy, which is increasing so alarmingly in all directions, especially in all manufacturing districts, has to day no foot-hold within Krupp's community. <sup>(1)</sup>

The Works founded by Alfred Krupp are animated by a spirit of concord, of common loyalty and trust, emanating directly from its head. His own religious

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<sup>(1)</sup> NOTE.—Of 36,905 votes cast in the city and district of Essen at the last Reichstag election, the social-democratic candidate received but 486.

tolerance and strict impartiality, in all directions, were as remarkable as were his efforts to promote among his employees a spirit of toleration and mutual affection.

No one sect stood first with him, duty well done was his only standard of merit. *“Every upright and industrious applicant is welcome to our community, and, no matter where he comes from or what he believes, has equal claim to protection and reward.”*

*“The Catholic workman was just as dear to me as the Protestant. I have never been a religious bigot, never limited myself to the employment of a certain sect. I have only demanded that the laborer be worthy of his hire.”*

*“I also desire that in the schools and on the playgrounds, which I have established, children of all confessions shall become friends, so that later, when grown to man’s estate, each one shall, according to his power and ability, ply his trade and earn his bread in my Works, in close association, and each on good terms with every other.”* *“Concord is the very foundation of contentment and of happiness in labor.”*

All the schools established by Krupp were non-sectarian. In this, as in all else, *equality*—in its truest sense—was his watch-word, and the cause of the spirit of harmony which prevailed where he ruled.

Any attempt, no matter whether concealed under the liberty-cap or under priestly vestments, to mar this social and religious peace, Krupp sternly combatted.

His admonition of July 24th, 1872, against the agitators who aimed at the destruction of religious concord, was supplemented by a second address on November 1st, 1873, in which he warns that “religious dissension destroys peaceful relations.”

On the occasion of the last Reichstag election, at a time when the ultramontane papers had attempted in a most

unjustifiable manner to cast suspicion upon one of Alfred Krupp's addresses to his workmen, and to sow the seeds of discord, he energetically met the insinuations of "those who for political ends, misuse and shame Religion."

"It appears to me that an attempt is making to create a chasm between my Catholic and my Protestant workmen—This is a most *shameless* proceeding."

Alfred Krupp's personality meets us in all these quotations. We see in them all, word and phrase, the man's mental peculiarities. The pride of a self-made man, tenderest charity, simplicity of nature, reverence for the demands of duty, plainest common-sense and noble intellect,—all are there to be found.

Alfred Krupp was of the chosen few, who recognize with intuitive insight the needs and demands of the age, have the courage of their convictions, and patiently, perseveringly, labor for a great end, overcoming all obstacles in their paths.

In the successful execution of well-considered plans, in the enjoyment of well-earned fruits of labor, in the glad recognition of his contemporaries, he found full re-payment for the efforts and struggles of a life full of work.

In 1826, in workman's overalls, at the anvil, swinging with hardened hands the blacksmith's sledge, in 1886, the ruler of a State within the State, one of the noted men of the century—in 1826, a workman, struggling against life's bitterest needs, most sorrowful cares, in 1886, the heaviest tax-payer of the great German Empire, the good genius of sixty thousand souls—*this* is the contrast sixty years present.

The little country town of 4,000 inhabitants is to-day one of the busiest manufacturing cities of the world, with 70,000 inhabitants, with great industrial wealth.

This wonderful development is the work of Alfred Krupp, the worthy successor of the patron saint and founder of the ninth century, Bishop Alfried von Hildesheim, nobly deserving as well, the title of *founder* and *benefactor*.

In the spring of 1887 Alfred Krupp began to droop, long years of care had undermined his vigorous health, no medical skill could long postpone the hour of summons. His strength decreased visibly and on July 14th, 1887, in the seventy-fifth year of his age, he gently closed his eyes upon his work here, to resume it in a higher sphere.

A man, for all time a celebrity of his century, passed out of sight, mourned by his, and all, countries, mourned by Kings and Princes, mourned most, as their truest friend, by the thousands of his own "kingdom."

To see the sorrowing hush that fell upon the whole city at the news of his death, to see the deep grief and earnest sadness of the crowds that followed him to his last resting place, to see the tears shed at his grave by those he had aided, those he had led to fortune, those who almost worshipped his genius, those who revered his noble deeds, by near friends, by admiring strangers, by high and low alike, was to see also what manner of man this had been.

A rare man, of highest genius, of largest heart—a duty-lover and doer, uncompromisingly severe upon neglect of duty, but most tenderly loyal to all worthy his confidence—a man whose yes was yes—his no, no!

A beautiful trait of his character was his touching love and reverence for everything connected with his hard times—nothing belonging to them was forgotten. His hospitality was proverbial, gentle and common

were welcome to his house, fond of good company he looked from principle for the joyous points in life,

“Work for the daylight, smiles for the night,  
Earn by *each* day's toil, a Sunday's delight,”

was his motto.

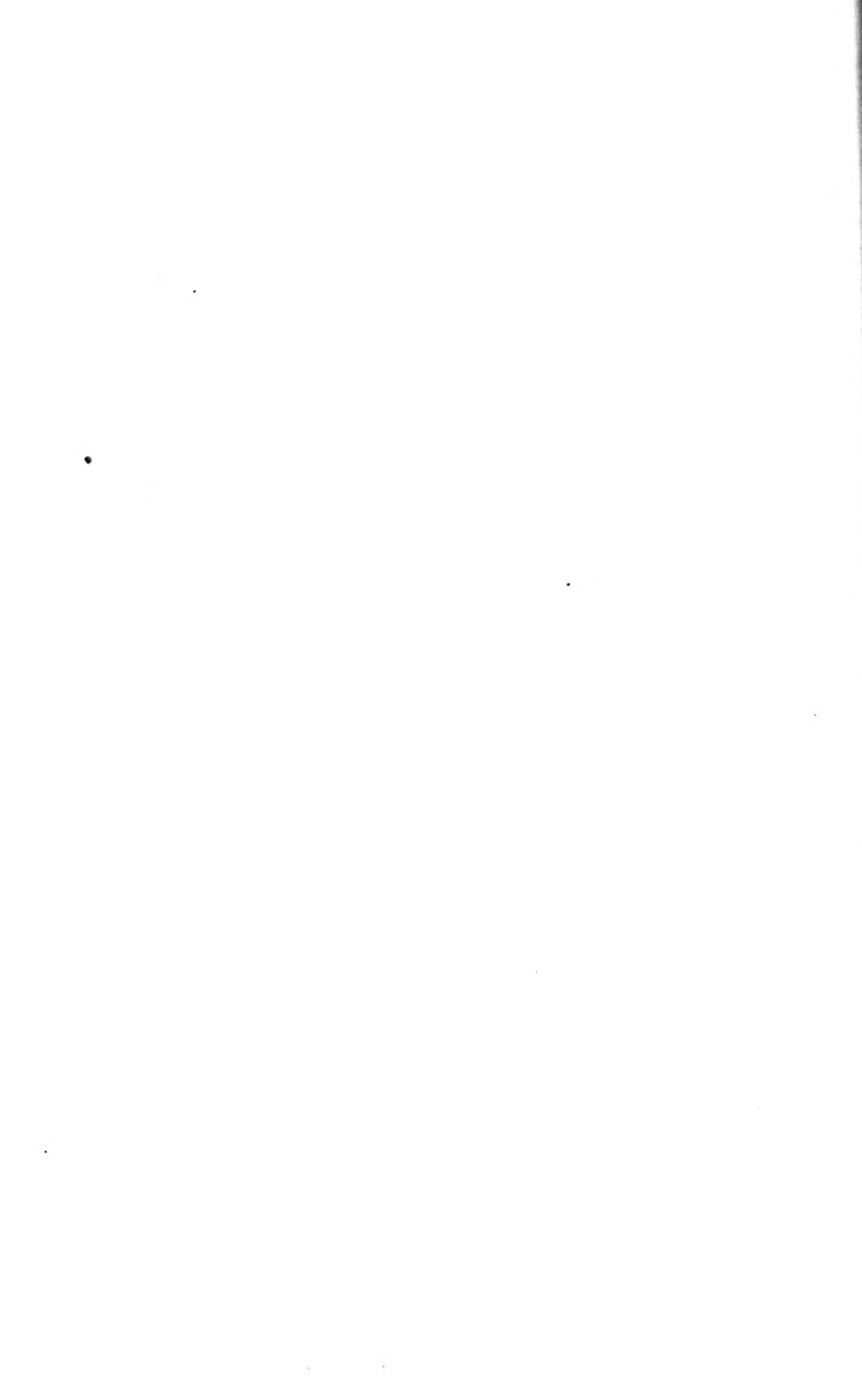
He was a charming conversationalist, joining to his knowledge and experience a keen sense of humor, which survived all his trials and perhaps lightened them.

“Shadow owes its birth to light,” the poet tells us, in *all* natures light and shadow are mingled, but in few, does the light so predominate as in Alfred Krupp's, shining in imperishable works of love, imperishable works of genius.

Alfred Krupp has builded his own monuments—those of *stone* and *iron*, which tell of his executive force and of his achievements in the field of industrial progress—those of *good deeds* and *benevolent measures*, which tell of the generous heart of which his mental powers were but the servitors.

“Write him as one who loved his fellow men”.





A VISIT  
TO  
THE KRUPP WORKS,  
AT ESSEN.

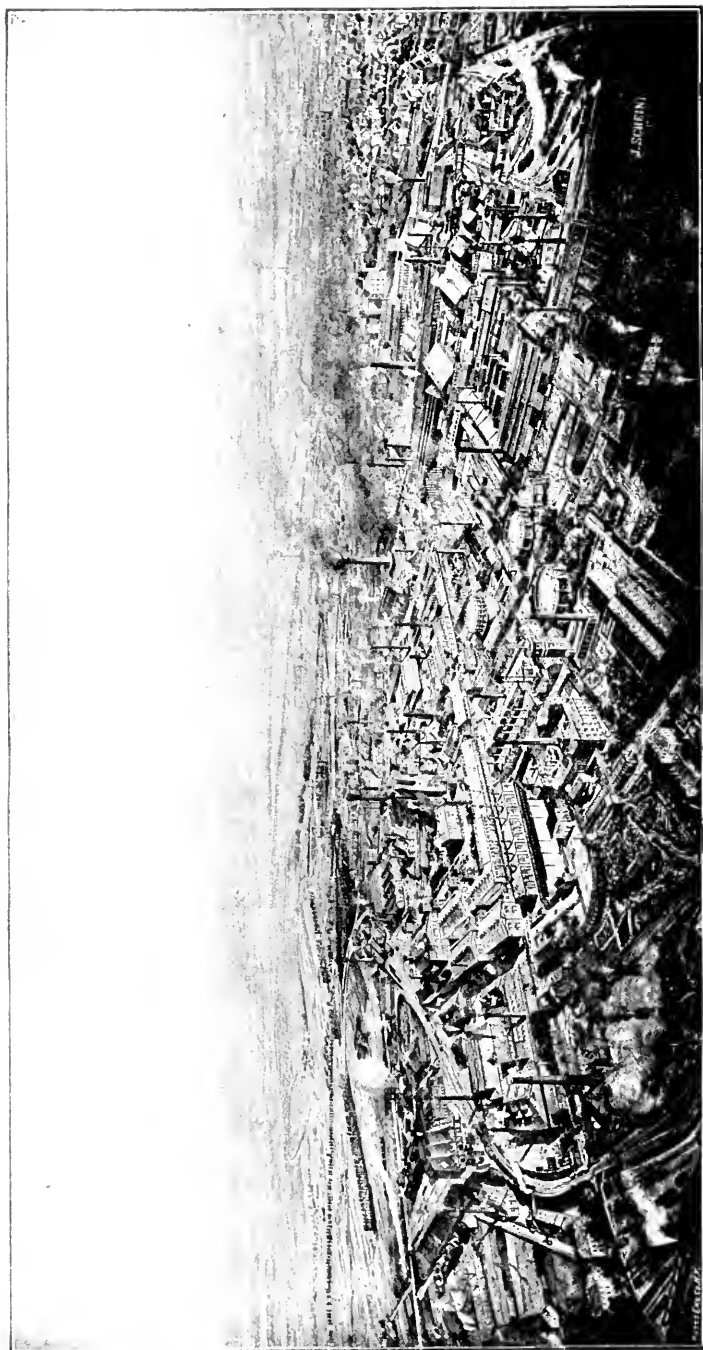
FROM THE FRENCH OF CAPTAIN E. MONTIAYE,

TRANSLATED BY CAPTAIN O. E. MICHAELIS, U. S. ARMY.









CAST-STEEL WORKS OF FRIED. KRUPP, ESSEN, GERMANY.

# A VISIT TO THE KRUPP WORKS.\*

If we have been fortunate enough to retain our readers' interest thus far, we will invite them to visit with us the great Krupp Works at Essen, which are so justly entitled to be called the pride of Germany.

## I.—ESSEN.

The city of Essen lies north-east of Dusseldorf, and is reached from Brussels by way either of Cologne or of Gladbach. It is situated in the fertile basin of the Ruhr, near Duisburg, another manufacturing city. Indeed, Essen is in the centre of the great factory district of Westphalia, a veritable hive of industry, in which are also to be found, Crefeld, Elberfeld, and Dortmund. These are not the only noticeable features of Essen's position, for it lies in one of those fortunate regions in which Nature has stored abundant coal and iron, the very bases of metal working.

To the Krupp Works Essen owes its world-wide reputation, and in a great measure, all its prosperity. In 1862, its population scarcely reached seventeen thousand, but the number of workmen employed in the great foundry increasing from day to day, the little town did not cover sufficient ground to shelter them all, and rapidly expanded. In ten years the population doubled, and to-day, encircled by a belt of attractive suburbs, the old city contains nearly one hundred thousand people. The impression is at once received that the whole town is more or less dependent upon the Works.

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\* From "Krupp and De Bange," New York, 1888.

Let us stand at about noon near the Mills, on the Essen and Duisburg turnpike which traverses them; at the twelfth stroke, the gates open, a flood of workers issues, and scattering, flows towards the comfortable, well-drained houses, which Krupp's fatherly interest in his people has provided at moderate rentals.

When the bell recalls to work, the city resumes its mediæval calm, and retains it until evening, when again the mighty multitude overflows its streets.

## II.—TURGAN'S PAMPHLET.

Turgan, who published in 1865 a description of the Krupp Works, as far as we know, the only one up to the present time, relates that he experienced a singular sensation when awakened in the early morning by the foot-falls of the men silently marching to their work. "The Germans on this side of the Rhine," the French writer tells us, "either have little to say, or talk in very low tones."

We were impressed in the same way, and, had our attention not been called to the fact, we should have thought of the still, impressive marching-by of an army. As we have mentioned Turgan, we may say that in many points, his description applies to-day; we have verified his statements step by step. His account of the fabrication of crucible steel is still, in the main, accurate. Of course it is hardly necessary to state that since 1865 every improvement, the result of scientific investigation or practical experience, has been introduced. Bessemer converters and Martin-Siemens furnaces are used in making commercial brands of steel, but—to us the cardinal, the essential point—for gun-metal, crucible steel *alone* is used, a steel produced here for over half a century, and to which the establishment owes its success.

### III.—FIRST IMPRESSIONS.

The Krupp establishment at Essen occupies about 1,000 acres, of which nearly 200 are under roof. Let the reader endeavor to realize what this really means. The buildings run north and south of the Dortmund and Duisburg turnpike. On approaching from the town, these rows of shops present an imposing sight; fifty, sixty, possibly more, structures, whose high chimneys or rather towers, are continually pouring forth showers of sparks, or thick clouds of smoke, the ponderous booming of the steam hammers, the loud humming of the engines, the signal whistles of the locomotives, laboring and puffing under their heavy loads, the black bulk of the enormous bulging gasholders for lighting the Works, all appear to be the embodiment of wonderful force and power, and bring up a vivid image of the man who, actuated by a determination as unbending as iron, a persistence as strong as steel, created this Temple of Work.

### IV.—THE ENTRANCE.

Here we are at the Works ; the gates do not open for every caller, everybody knows that. Admission is positively refused to all metal makers or workers, these must tarry in the reception room. This prohibition is not due altogether to a useless desire for mystery, still there are processes, the results of several generations of experience, which are kept secret. Were all admitted, the crowds of sight-seers, who would be attracted by the great reputation of the Essen Works, would require an army of guides to conduct them through the labyrinth of shops. The attention of workmen would be diverted, the prompt handling of huge masses of metal would be delayed. Such continual interruptions would be a great nuisance, certainly causing loss of time and money, without the slightest return, for Krupp's reputation is made. As to

interested visitors, manufacturers, scientific and practical experts, etc., it certainly would be the height of folly to permit them to wander at will all over the Works, and study at leisure the thousand peculiar details in vogue, any one of which may for the moment assure especial advantage. Whatever may be said, we regard the experience gained in a life-time of incessant work and unparalleled activity such as Krupp's, as a precious possession, whose influence outweighs all else in the daily improvement of manufacturing methods.

To allow the keen glances of rival manufacturers an opportunity of noting and appropriating the fruits of such life-long labors and experience, would be silly and weak, and against the interests of thousands who are dependent upon the Works for their living. It would be a voluntary cession of all rights.

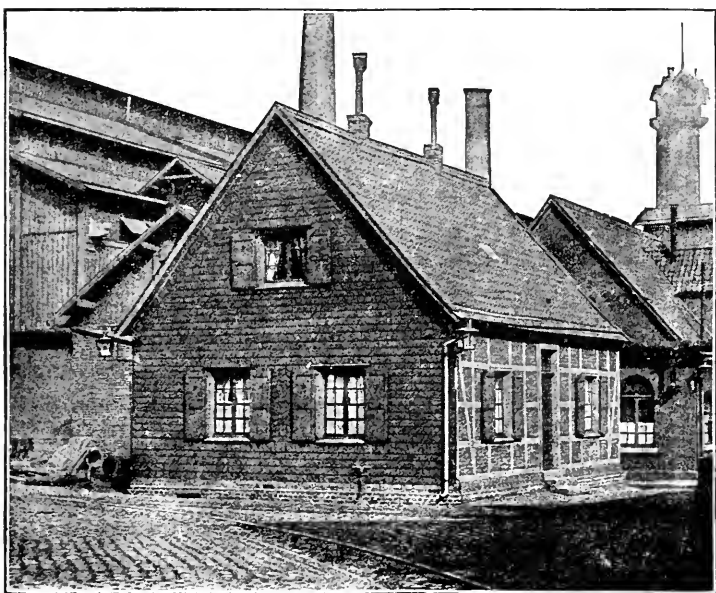
#### V.—THE OFFICE AND KRUPP'S COTTAGE.

But a truce to these prefatory comments, let us enter. The gatekeeper, one of a number, whose long uniform overcoat suggests the old soldier, eyes us as keenly as a customs inspector scrutinizes a passenger suspected of smuggling; we make no sign, however, and as we are under proper guidance, Cerberus hides his tusks.

This great building which first meets our view is the Office, where a regiment of accountants pass their days in keeping the books of the great firm.

Here is entered everything that goes out and comes in, here are kept the accounts of the States dealing with the Works. We felt a longing to peep, were it but for an instant, into the great ledger, whose contents must be exceedingly interesting, but we did not seek to indulge our indiscreet curiosity; besides we had so much to learn that we did not dare jeopardizing, for the gratification of an idle whim, further opportunity of gaining information.

Close to this brick structure, there is a cottage, such a one as Jean Jacques Rousseau sighs for, with green blinds, small square lights and clean white window curtains; it is pretty and attractive, and had not a locomotive, drawing iron laden cars, rudely interrupted our train of thought, we should for the moment have believed ourselves rustivating amid Swiss mountains.



In this little house, the father of the present proprietor passed his life in making the incomparable steel which has made the Works to-day famous.\*

He was not spared to see the full fruition of his life-work, but the tool which his aged hand could no longer wield, was firmly grasped by his son. With the help of a few mechanics, he set to work, by his perseverance he conquered all difficulties—the result is known.

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\* See note on page 71.

This humble cot, almost lost amidst its towering surroundings, has been kept as an experimental laboratory, and here Krupp's son works daily ; it is the family talisman, and the recollections which it calls into life make up the history of two generations, devoted to labor and to duty.

## VI.—THE GUN SHOPS.

Our obliging guide takes us first of all to the gun shops; we enter an immense roofed space, we must apologize for the frequent use of this adjective, but it alone, is descriptive—where about one hundred Krupp field-guns are receiving their final touches.

These little playthings, so neat, so pretty that one feels like using them for watch charms, are for his Highness the Sultan of Turkey. He seems to be in a hurry for them, as they are in hand day and night.

We enter a second shop, then a third, both of colossal dimensions ; in one, the guns are turned, in the other, bored ; here, grooves are cut, there, the breech mechanisms are constructed.

We will not dwell upon this phase of our visit, for though we saw the many operations necessary to convert the unfinished tube with its mantle and hoops into a gun, yet in the main they are similar to those pursued in other gun factories. Only, here, the work is done on a grander scale. As elsewhere, great lathes turn with ponderous dignity, fleet pulleys whirr on their shafts, metal parts groan under the biting of smoothing files; here, however, the hundreds of lathes, the thousands of pulleys, and the steel fashioned by numberless tools, constitute a grand orchestra, ever performing the impressive symphony of Work.



## VII.—THE FOUR 120-TON GUNS.

In an adjoining shop, the great guns are majestically enthroned; the Leviathans of naval armament, the Behemoths of coast defense. Man feels his insignificance in the presence of these awe-inspiring engines, yet he is their lord and master. Among all these finished masses of pure steel, at whose sides a horde of mechanics are busy, four especially rivet the attention of the beholder; they are the 40 cent. guns, 14 metres long, and weighing the trifle of 120 tons, say one hundred and twenty thousand kilograms! And yet but a few years ago, the 100-ton iron gun with steel lining, made by Sir William Armstrong for the "*Duilio*," was emphatically announced as the supreme effort in the struggle of ordnance against armor, the final outcome of constructive ability! Here the metal is not iron, but steel entirely, and crucible steel at that. The charge of each crucible is only 40 kilograms, and the reader can picture to himself the amount of work embodied in each of these pieces, in remembering that the casting of each involves the simultaneous pouring of from 1,700 to 1,800 crucibles, yielding an ingot of 70,000 kilograms. As each gun consists of tube, mantle and rings, this Titanic operation must be repeated twice for each piece, as the rings alone permit the use of much smaller ingots. The ponderous blocks of steel required for these enormous guns are nevertheless forged and finished with comparative ease, so great is the capacity of Krupp's tools and so daring the intelligence which directs them.

These guns were ordered by the Italian Government for sea-coast defense. \*

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\*Two of these guns are now embarking at Antwerp for Spezia, their destination. The others will presently follow by the same route.

The press questioned the practicability of transporting these ponderous and unwieldy productions, and asserted that the rails would give under the weight of so exceptional a load. But the problem was readily solved by Krupp's engineers; a platform car was constructed, running on thirty-two wheels with independent axles, so arranged that the whole weight was equally distributed upon all the wheel bases.

#### VIII.—THE CARRIAGE ASSEMBLING SHOP.

We regretfully left this interesting sight to enter another structure in which are the assembling shops for naval and sea-coast carriages. Communicating galleries are built at a height of 10 metres between the shops. From one of these we glanced above us at the traveling cranes of 50,000, and 30,000 kilograms' capacity, which, at a height of 15, and with a span of 22, metres, traverse the great shops, lifting and shifting the heaviest masses, working automatically by bell signals.

Below us we see in hand a carriage with rotating platform protected by a sheet steel cupola. This model is designed for a great ironclad, the pride of modern navies. Other carriages, of established model, with hydraulic buffers and shot-cranes are ready for the cars, for the track that serves the Works and connects with the Government Railroad system, begins at these shops, and is thus a terminus of the main lines.

Let us go down to get a nearer view of the work of assembling; let us see how the cupola turns on its rollers. Stop, it is moving. "She doesn't work badly," said the foreman, "a little filing here and there, and she's all right." Above us the crane advances, goes back with impressive deliberation, making nothing of its huge loads, and, from time to time, the click of gearing and the ringing of a small bell reveals the existence of the

train that moves this indispensable apparatus ; and everything goes apparently in a routine way, quietly, without excitement or shouting ; little is said in the Krupp establishment, but the work goes on all the time. At the four corners of the edifice, ponderous lifts are installed, and taken all in all, we are sure that there could not be a better disposition of the powerful mechanical devices with science has placed in the hands of the constructor. But let us hasten to examine the various processes of steel making in use here, for the Essen Works turn out Bessemer, Open-hearth, Puddled and Crucible steel.

#### IX.—THE BESSEMER PLANT.

Bessemer steel is made on a great scale at Essen, ten thousand tons of rails can be made per month. This shows that Krupp is not unwilling to take advantage of scientific progress, in whatever direction it trends, and does not disdain to make cheap steel to meet the wants of all railroad interests. But we must make no mistake; he uses the Bessemer process only for making commercial brands.

Interested parties have started a rumor that the crucible steel which alone is used for gun-metal, is made in part by remelting Bessemer scrap. We have assured ourselves by watching the charging of crucibles that this rumor is entirely baseless. It would be still more audacious to assert that the converters furnish the ingots required for tubes, mantles or even rings, for we looked in vain for moulds at the Bessemer Works of sufficient size for the purpose, or for cranes powerful enough to handle the great blocks out of which the gun parts are fashioned. The fact is apparent that the Works are especially equipped for the output of the small ingots required in rail fabrication. The Bessemer process is so

well known, even taking into account the most recent improvements, that it would be a thankless task to attempt a description here : whoever has seen it in operation must recall the absorbed interest with which he watched it ; the gorgeous pyrotechnic display of “blowing off,” the silvery sheen of the sheet of living steel flowing from the converter’s mouth amid a scintillating halo into the devouring maw of the charging ladle. Once seen, this fairylike spectacle can never be forgotten.

We witnessed every detail of rail fabrication, from the billets’ leaving the heating furnace to undergo transformation in the roll trains, to the last mechanical operations, cutting to length and straightening.

We think that, in this manufacture, our own makers are not behind Krupp, and that they do the work just as well, and as economically. But the old saw, “Shoemaker, stick to your last,” comes to mind, let us stop talking of rails, concerning which we have nothing new to say.

#### X.—THE OPEN-HEARTH PLANT.

Krupp also makes steel by the Martin-Siemens process, which besides affording facilities for determining the character of the bath by the drawing of test specimens, yields a more constant and homogeneous product than the Bessemer. It is slower, we must admit, but it is more certain ; the carbon point can be so regulated that we can obtain the hardest as well as the softest metal, steel suitable for springs or for boiler plates. The open-hearth plant is extensive and well arranged. The reverberatory furnaces, in which the molten metal simmers under the action of the flame, are arranged in two rows, having between them cranes of medium capacity ; under these are the casting pits. Here, as at the Bessemer plant, there is no sign that open-hearth steel

is used for gun-metal ; no deep pits, no gigantic cranes. Not a particle of this steel goes into the crucibles, we assert this without fear of denial, for we have at hand convincing evidence.

Open-hearth steel is used at Essen for the fabrication of all kinds of plate, tires, axles, and other structural parts; also for all castings, such as car-wheels, cross-heads, hydraulic cylinders, and in general for all machine members which do not need that absolute homogeneity and exceptional strength demanded by gun-metal, and which so especially characterize crucible steel. As we entered the foundry, the work was in full swing; the furnaces flamed with dull crackling, and the crane moved along the great bay holding suspended the pouring ladle : at intervals, when above a mould, a stream of molten metal gushed out, momentarily as with a lightning flash making darkness visible, and disappeared in the glowing receptacle. In front of the Works, numerous castings, just from the moulds, were slowly cooling under slag ; they were truck wheels. These castings are not to be trusted, inoffensive as they look ; they remain hot for a long time, and those who walk about carelessly, are apt to carry away ardent and lasting reminders.

#### XI.—KRUPP GUN METAL.

##### *The Puddled Steel Plant.*

It is easily understood that the portion of the establishment devoted to crucible steel making, the metal of which all Krupp guns are constructed, possessed the greatest attraction for us. Besides, with or without reason, all sorts of myths attached themselves to this mysterious metal, and the probabilities are that had the famous gun maker lived in the dark ages, his unlucky competitors would have accused him of witchcraft, and the stake would have effectually disposed of an inconvenient rival.

We were anxious, as was natural, to clear up the mystery ; and we had been promised help. Further, we had resolved to keep as “ wide awake ” as possible. As the result of this somewhat underhanded investigation, we are convinced that it is impossible to find a method of making gun-metal upon a more scientific basis, or one more exactly carried out ; everything is designed and regulated for the purpose of producing a steel which chemically and physically is able to cope with the most powerful powder efforts.

The iron ores used by Krupp in the fabrication of his gun-metal, are of the very highest grade and of remarkable purity. As a rule hematite and spathic ores are used, the same ores from which that excellent cast-iron, called by Germans *spiegeleisen* and by the French *fonte miroitante*, is made. They come either from the Siegen region, or from the firm's mines near Bilboa in Spain.

The iron is delivered at the Works in pigs, and makes up the charge of the puddling furnace. The puddling is under control of experienced and tried workmen ; indeed a regular puddling school exists at Essen ; no one can become a boss until, after numerous and difficult trials, he has proved himself thoroughly up in all the details of the art. Of course, puddled steel is made at Essen upon the same scientific principles as in England, France, or Belgium. While *science* is the same everywhere, each mill has its own special “ knack ” which characterizes its output. We will go a step beyond, and affirm that were Krupp to establish Works in some foreign country, without taking with him his mechanics, his ordnance experts, and his foremen, many of them men born within sight of his establishment, most of whom have grown gray in his service, the steel he would there make, would be different from that produced to-day at Essen. The determining conditions are indigenous to the soil, and

dependent upon the generations of workmen evolved under their influence, just as the tree clings by its roots to its mother earth.

Let us however return to the iron about to be partially decarburized in the furnace. It is vigorously assailed by the fire, and thoroughly rabbled by the puddler; the excess of carbon is driven off, and the iron becomes steel.

The skill of the puddler lies in stopping the operation at the exact moment when the iron comes to nature; if this passes, the work is lost. The loop, or ball, as the spongy steel mass is called, is carried on a trolley to the steam hammer; the metal is squeezed under its blows, and slag and other impurities are expelled, the molecules are condensed, arranged, and rammed together, and the ball becomes a billet. This hammered billet is then taken to the rolls, and leaves them as a long square rod, which is at once hardened in a pool occupying the centre of the mill. Each rod, after critical inspection as to quality, is broken into pieces about 20 centimetres long, which are sorted accordingly. The toughest and most homogeneous are reserved for gun-metal charges; the others are classed for special work, such as crank-shafts, axles, high grade tires, &c. The advantage of this procedure is self-evident; the expert can, so to speak, after the crucible charge has been fixed, determine beforehand the strength which the melt will possess, and as it is worked in small masses, there is the greatest possible chance of securing almost perfect compactness.

The puddling Works always present a busy appearance; the steel bubbling in the furnaces is energetically stirred and worked by the rabbles of the puddlers; these are fine fellows, all nerve and muscle, whose perspiring faces, occasionally lighted up by a sudden flash of flame, bear testimony to the hardships of their trade.

Here the steam hammers angrily pound the unwilling

billets, further along, the glowing bars writhe in audible agony through the roll grooves. Add to this the whirring of the pulleys, the clanking of the chains which hold the roll tongs, that guide the heavy masses of steel, the calls of the bosses, the chant of the hundred ovens in which iron and coal crackle, the heavy puffing of the steam motors, and you have a picture in ever varying colors of one of the most magnificent phases of modern industry.

Puddled steel, which by the very principle and method of its fabrication, is assured great uniformity, is the base of the crucible charge; the rest of the alloy is puddled iron. This is made of special pigs and worked in the manner just described; it gives tenacity to the compound. It is rather refractory, but then the puddled steel, the greatest part of the charge, has a comparatively low melting point, and a certain flux, one of Krupp's "secrets," is added. We came to the conclusion that charccal was its main ingredient. The crucible, whose contents weigh exactly 40 kilograms, is carefully luted, heated in the warming oven, and is then exposed to the high temperature of the melting furnace.

## XII.—CRUCIBLE MANUFACTURE.

This is the proper time to speak of the melting pot, the crucible.

It is made of a special composition, peculiar to the Krupp Works.

We witnessed the manufacture, and came to the conclusion that the mixture consisted mainly of fire-clay with a less proportion of graphite.

The material of which the crucible is made exercises a great influence upon the final constitution of the melted contents. Krupp has made this a subject of exhaustive investigation, for the Works consume an enormous



number of crucibles, as each can be used but once. No further evidence of this is needed than the piles of charred and broken pots stacked in the shop yards.

A part of this waste material however is utilized ; it is ground into powder under huge vertical stones, and is thus rendered fit for use in making new crucibles. New composition and old dust are ground fine, mixed in great vats, and thoroughly worked up with the utmost care into a thick pasty slip. The crucible is now to be moulded.

Imagine a hollow cast-iron truncated cone, the mould, and a solid metal core of suitable size and similar shape, which fit to just the dimensions of the prescribed crucible. Now fill the mould with the proper quantity of slip and slowly enter the core ; the compressed plastic material flows between mold and core and shapes itself ; the excess seeks to escape, but is held in by a collar and forms the rim. The pot is then taken out of the mould and dried.

The Works as already stated, consume daily a very large number of crucibles, for as a rule, four crucible casts are made every twenty-four hours. The drying and storing rooms are in immense four-story edifices with spaced flooring on which the crucibles stand in long rows. The Superintendent of this important branch told us that there were always one hundred thousand crucibles in store, which are used in succession. We could not verify this statement, but we are sure that it would have taken us hours, possibly a whole day, to count them.

### XIII.—THE CRUCIBLE STEEL PLANT.

#### *Casting.*

We come now to crucible casting, which in every way is the most singular, the most interesting, and the most picturesque work we saw during our whole visit. The

foundry stretches out almost interminably, and is furnished with all the apparatus necessary for the successful carrying out of this delicate and difficult work. Upon the extended sides, along the walls, are installed the gas heating-ovens; parallel to them in two lines are built the melting-ovens flush with the ground, and connected by subterranean galleries for the service of the attendants.

The Krupp establishment uses in its crucible steel plant about 130 coke and 30 gas ovens. Each oven has a capacity of 12 crucibles. Some however can hold 18, so that casts of from 1,600 to 1,800 crucibles, even more if necessary, may be easily undertaken. The largest steel blocks cast at Essen up to the present time weigh 70,000 kilograms, required in the construction of the 120-ton guns. About 1,700 crucible charges were needed in casting them.

Along the center line of the structure the casting pits are dug, and the movable cranes are located. The process of casting is in itself of absorbing interest; it is a striking illustration of the precision and coolness of the master founder, of the discipline and skill of the workmen.

When the steel in the crucibles has reached the desired melting temperature, after being from four to five hours in the furnace, the master founder places the mould, as near as may be, equidistant from the active ovens. He then sets up the casting runners, heavy sheet iron channels lined with fire-brick. These runners lead the liquid metal in corruscating streams to the gate which surmounts the mould in which they are engulfed. The foundrymen are dressed in two long lines, facing to the centre and divided into threes and twos. One of each three, carries a tongs, the others a rod very much like a brewer's mash ladle. As soon as the master founder has completed his preparations, and, upon in-

spection ascertains that the proper melting point has been reached, he gives the signal, the oven covers slide back, and the casting begins. The melter with the tongs clasps the crucible and resting the curved tong handle upon the rod, held by the other men as a fulcrum, he lifts it out of the oven. Keeping it vertical, the three place it on the ground some distance from the furnace. Then the other two take it, and pour its contents into the runner.

The empty pots are thrown in a heap out of the way of the workmen. Group silently follows group; the crucibles shimmer through the foundry in a meteoric shower; the silence is broken only by the clatter of the sliding oven covers and the crackling of the molten streams as they glide in the runners toward the flask into whose fiery mouth they plunge in a glittering cascade.

The incessant sheen which intoxicates the eye, the intense heat coming in blasts from the underground fires, the silent traffic of the workmen, all bring to mind some witches' Sabbath of the Reign of Terror. In a word, it is a magnificent drama of intense coloring and unapproachable grandeur, worthy the brush of a Callot.

To those who feel it incumbent upon themselves to suggest that we are drawing upon our imagination, rather than our memory, that enthusiasm induces us to throw a halo about the description, we can only reply, ask others, who like ourselves, have *seen*.

We may say that it is mathematically certain that the casting, even if an 80,000 kilogram ingot be in question, *cannot* fail.

Krupp's workmen are thoroughly trained in that iron discipline, well taught in that characteristic Prussian school of steadiness, which affords undoubted assurance of success. Cast-steel chills quickly; the ingot is drawn from the pit by one of the powerful foundry cranes, and

carried to an adjoining shop, where a fire-brick wall is built about it, to prevent chilling to the very core, which would retard forging. But before the block is shaped, it is reheated in one of the furnaces convenient to the hammer, and at the right temperature, it is taken out, swung by a triple chain-sling to a crane, which by deft movement, lands it on the anvil.

#### XIV.—THE 50-TON HAMMER.

A word about the 50-ton hammer, so long the boast of the Krupp Works.

Imagine a square steel head, 3.70 metres long, 1.50 metres wide, and 1.25 metres deep, a mass of seven cubic metres, hung at a height of 12 feet in an arch five metres high, whose supports are 1.50 metres in diameter. Now a steel anvil, resting upon successive foundations of masonry, oak, a whole forest was required, and cast-iron, finally, in your mind's eye, put the glowing ingot under the hammer head. The hammer boss, a veteran artist in blue glasses, for it is impossible to watch the incandescent mass with the naked eye, is in direct charge. At his right and left are the men who grasp the chains encircling the monster, and who, at a hand wave, without a word or order, oscillate the block until the desired position is attained. The hammer slowly descends, the head hardly touches the ingot, then, after a rapid inspection, it is quickly raised, and comes down with all its might upon the metal which quivers and gives under its terrible blows. About the hammer the ground trembles as with an earthquake wave. Stop! the hammer rests, the block is turned on its side, the machine takes breath again like a Colossus raising his club to brain the enemy, and pounds again upon the bruised mass, which finally gives way under this storm of blows; the block is forged.

The 50-ton hammer was built about twenty years ago and cost the small sum of 500,000 dollars, but it must be admitted in excuse that it earns its living honestly, and pays good interest on its cost. At that time Creusot had only a 12-ton hammer; now however there are 80 and even 100-ton hammers.

“Why,” it is asked, “does Krupp suffer himself to be outdone by his rivals?”

We must first note that the Essen hammer has really an effective weight of 60 tons, and the heaviest blocks forged weigh, as already mentioned, 70,000 kilograms. These blocks are bored; the forging can therefore be altogether effective, for the hammer blows need not penetrate to the heart of the block. Further the monster guns now constructed date back only a few years. Although up to the present, more powerful mechanical contrivances were not required, yet for some time past, Krupp has contemplated erecting a hammer of much greater weight, and the matter is so far advanced that within a few months Essen will again surpass its rivals in its ability to forge the very heaviest steel masses. It would hardly be proper for us to say more on this subject. After forging, the shapes are subjected to a peculiar annealing process, and are then transferred to the gun shops for finishing and assembling. We will not dwell upon the other products of the Works, steel-cast wheels, coil and elliptical springs, tires, &c., all abounding in interest, and which in themselves justify Krupp's great reputation. We examined the entire plant with sustained interest, but we cannot within the scope of this paper, undertake to impart our impressions.

#### XV.—THE MODEL COLLECTION.

Before leaving, let us glance at the collection of models, or rather the museum of the Krupp Establishment.

It contains specimens of every gun and military construction designed or improved by Krupp ; it tells the eloquent story of his researches and his labors. Here are steel and iron plates which have been used as targets in the various experiments that have lengthened out the struggle between armor and gun ; here are samples of ores, test pieces of gun metal, fragments of experimental guns fired to destruction, mute witnesses to the enduring patience and multifarious knowledge which characterize the continued researches of the tireless German Constructor.

Here can be seen all the stages of his fermature, before it reached its present degree of perfection. Here are guns of all systems, the breech mechanisms of Wahrendorf, Kreiner, and others, in a word, everything to interest Artillery and Ordnance officers of every country. In the centre of the museum stands, bright and attractive, a Prussian battery, as it leaves the Works. Every expert in the fabrication of war materials must admit that the Krupp output is treated, even to the smallest details, with the utmost care.

A great General has said "that the Prussian army is the most perfect military machine in the world," surely then its present war material deserves a large share of this meed of praise.

We must not overlook the collection of the different projectiles made at the Works, from the shell for the 7.8 cent. gun, to the 1,050 kilogram hammered and hardened steel armor-piercing shell for the 120-ton gun, culminating in one still more phenomenal, 1.80 metres long, (4 calibres), weighing 1,500 kilograms, to be fired from the projected 45 cent. gun of from 140 to 150 tons weight.

#### XVI.—KRUPP'S PROVING GROUNDS.

Krupp has facilities in connection with the Works for proving finished guns. The piece is placed in a vault

whose walls are thick enough to retain the fragments in case it should burst during endurance trials. The gun is brought to the shaft by rail, and lowered upon the carriage by a crane. At the word "ready", everybody leaves, and the piece is fired by electricity. The projectiles lodge in a butt, 100 metres in front. This test, we repeat, is for the purpose of noting the general behavior of the piece, but also gives the initial velocity and the gas pressure.

Complete ballistic experiments, the determination of ranges, accuracy and similar data, are conducted at the Meppen Proving Ground, owned by Krupp, where, thanks to a range of 16,800 metres and the latest apparatus, they can be pursued on the most extended scale.

#### XVII.—AN EPITOME OF THE KRUPP PLANT.—KRUPP.

We conclude our task with some data which will give a better idea than any words of ours of the magnitude of the Krupp plant, and its steady progress since 1810, the date of inception.

In 1883 the plant comprised :

- 1.—The Essen Steel Works,
- 2.—The Essen and Bochum Coal fields,
- 3.—547 Iron Mines in Germany,
- 4.—Several ore beds near Bilboa,
- 5.—Four Smelting Works near Duisburg, Neuwied and Sayn,
- 6.—The Meppen Proving Ground,
- 7.—Four Steamships,
- 8.—Various stone quarries, clay banks, and sand pits.

There are in operation :

- 11 Blast furnaces,
- 1,542 Furnaces of various kinds,
- 439 Boilers,

82 Steam hammers from 100 to 50,000 kilograms,  
21 Roll trains,  
451 Steam engines, of 18,500 horse power total  
capacity, of which many, we are glad to say, were made  
by Vanden Kerchove, the well-known Ghent builder,  
and finally,  
1,622 machine tools.

The total output of the Essen Steel Works amounted  
in 1881 to 260,000 tons, including Crucible, Open-hearth,  
Bessemer steel, and Homogeneous Wrought iron.

It is generally supposed that Krupp manufactures  
only guns, of which he has made to date, 21,000; carriages,  
ammunition wagons, projectiles and fuzes, in a  
word, ordnance material only.

He also supplies, as we have seen, rails, switches,  
axles, tires, locomotive and car wheels, everything required  
for road beds or rolling stock; he rolls boiler and  
ship plates, constructs bridges of all kinds, forges crank-  
shafts, anchors, and structural parts for the merchant  
and naval service.

He serves the wants of commerce and trade as satisfactorily  
as he meets the demand of warfare. We will  
add some figures, gleaned at hap-hazard;

The Works consume:

*Coal and Coke*; 3,100 tons per work-day, about 1,400  
tons of which are chargeable to the blast furnaces and  
steamers.

*Water*: From 5,000,000 to 7,000,000 gallons per work-  
day.

*Gas for lighting*: From 475,000 to 1,500,000 feet per  
work-day.

The blast furnaces are charged daily with 1,400 tons  
of ore from the Krupp mines. The shafts and drifts  
deliver daily an average of 3,000 tons of coal.

For internal traffic there are 27 miles of railroad  
standard gauge, with 14 locomotives and 539 cars, and



15½ miles of narrow gauge road, with 14 locomotives and 344 gondolas. There are besides 71 horses with 191 carts, 40 miles of telegraph lines with 35 stations, and since 1884, 100 telephones.

The plant has exclusively for its own needs, a chemical laboratory, a photograph gallery, a printing office, and a book bindery. There is a fire brigade of 70 men and 32 fire alarms. The Commissary Department, whose transactions in 1882 reached nearly a million dollars, includes; a hotel, nine beer gardens, a mineral-water factory, a steam grinding mill, a bakery, an abattoir, one clothing and two shoemaking establishments, forty-six grocery, haberdashery, dry goods, hardware and other shops.

At the last general census taken in September, 1881, the total of employees footed up 19,605, of whom 11,211 belonged to the Steel Works, and 8,394 to the Smelting Works, mines, &c.

The other members of the families numbered 45,776, of whom 13,083 were school attendants, so that the entire population dependent upon the plant amounted to 65,381 souls. 18,698 of these occupied dwellings belonging to the establishment. We will not speak of the various institutions for the public comfort, the dormitories for unmarried men, the baths, hospitals, manual training schools.

According to the old saying that "the left ear rings when good is spoken of us," Krupp must be unable to hear his own words, for no one else does the good he does.

A word concerning Krupp, the very soul of what we attempt to describe.

The present owner is an octogenarian, whose rugged health and ceaseless activity defy age and sickness.\*

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\* Since these lines were written, the world has been called upon to mourn the death of Alfred Krupp, crowned with years and honours, July 14th, 1887.

He is still the prime mover in all the great enterprises, undertaken by the Works. As Commodore Vanderbilt was called "The Railroad King," so has he been named "The Cannon King."

This regal title—hardly intrinsically applicable to the great American financier, who restricted himself to the purchase of blocks of stock in sound and paying roads, and never built a mile of line in his life—is a just tribute to Krupp, for he *himself*, made not only the guns but also the necessary metal.

E. MONTHAYE.

Brussels, January, 1887.

# MULTIPLIERS

FOR

## Converting French into British Measures.

|     | Metres<br>into<br>Feet. | Metres<br>into<br>Yards. | Millimetres<br>into<br>Inches. | Kilograms<br>into<br>Pounds. | Tonneaux<br>into<br>Tons. |
|-----|-------------------------|--------------------------|--------------------------------|------------------------------|---------------------------|
| 1—  | 3.2809                  | 1.0936                   | 0.03937                        | 2.2046                       | 0.9842                    |
| 2—  | 6.5617                  | 2.1872                   | .07874                         | 4.4092                       | 1.9684                    |
| 3—  | 9.8426                  | 3.2809                   | .11811                         | 6.6139                       | 2.9526                    |
| 4—  | 13.1235                 | 4.3745                   | .15748                         | 8.8185                       | 3.9368                    |
| 5—  | 16.4043                 | 5.4681                   | .19685                         | 11.0231                      | 4.9210                    |
| 6—  | 19.6852                 | 6.5617                   | .23622                         | 13.2277                      | 5.9052                    |
| 7—  | 22.9661                 | 7.6554                   | .27559                         | 15.4323                      | 6.8894                    |
| 8—  | 26.2470                 | 8.7490                   | .31496                         | 17.6370                      | 7.8736                    |
| 9—  | 29.5278                 | 9.8426                   | .35433                         | 19.8416                      | 8.8579                    |
| 10— | 32.8087                 | 10.9362                  | .39370                         | 22.0462                      | 9.8421                    |

1 Centimetre=10 Millimetres=0.3937 in.= $\frac{4}{10}$  of an in. nearly.

1 Tonneaux =1000 Kilogr's=0.9842 ton=1 gross ton      “

1 Kilogram =2.2046 lbs.                      =2 $\frac{1}{5}$  lbs.        “

1 Metre = 3.2809 feet = 1.0936 yds. =  $\begin{cases} 3\frac{1}{4} \text{ feet} & \text{“} \\ 1\frac{1}{8} \text{ yards} & \text{“} \end{cases}$



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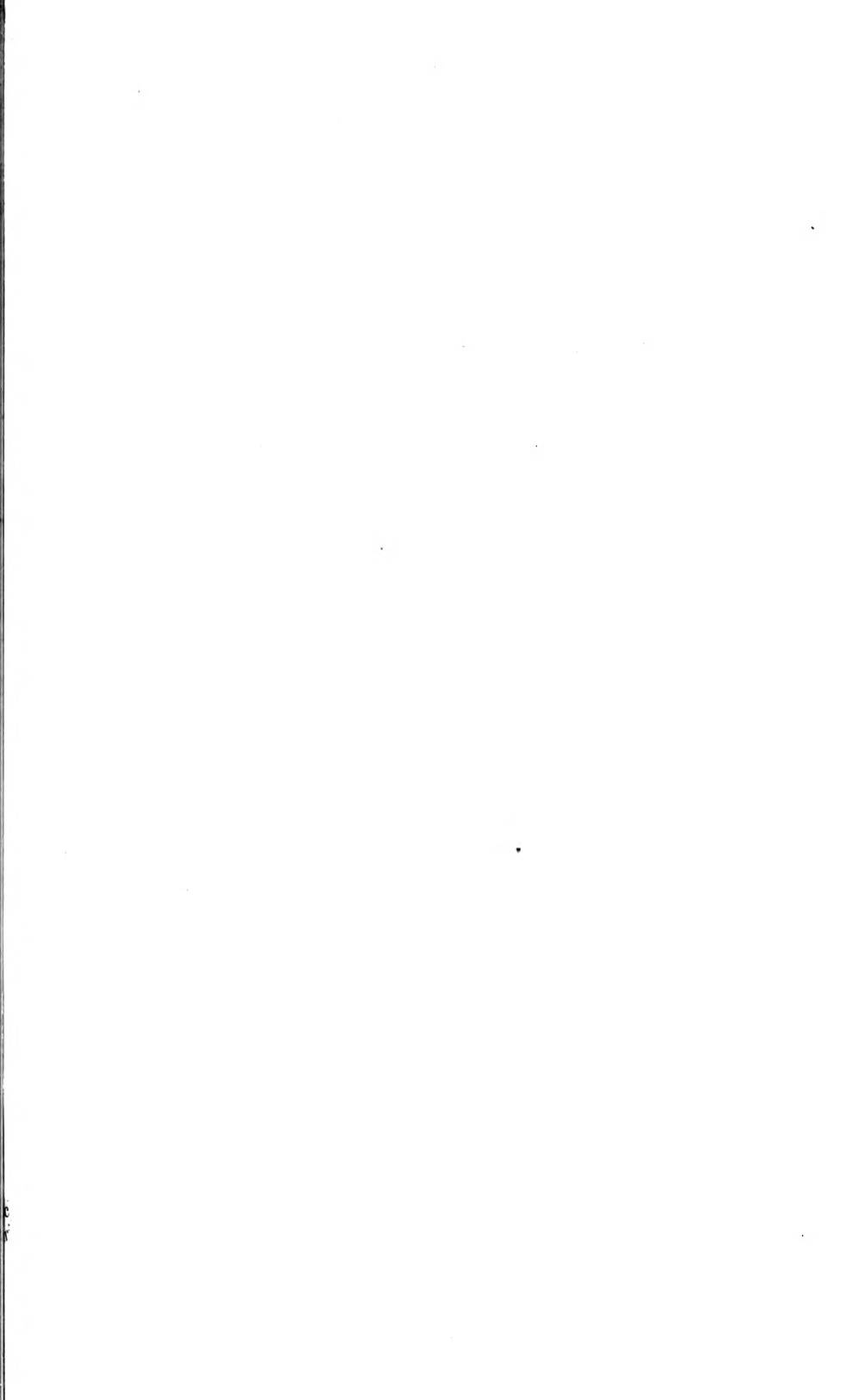












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